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AIRFIELD PAVEMENT EVALUATION

SPRINGFIELD AIR NATIONAL GUARD BASE OHIO

SEPTEMBER 1991

AFCESA

AIR FORCE CIVIL ENGINEERING SUPPORT AGENCY
TYNDALL AIR FORCE BASE,
FLORIDA 32403-6001

AIRFIELD PAVEMENT EVALUATION

SPRINGFIELD ANG BASE

OHIO

PREPARED FOR

AIR NATIONAL GUARD

BY

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EXECUTIVE SUMMARY

A Headquarters Air Force Civil Engineering Support Agency (HQ AFCESA) Pavement Evaluation Team conducted a destructive structural airfield evaluation of Springfield Air National Guard Base, Ohio, during 2-9 April 1991. Field testing included CBR and plate bearing tests in seven pits, 48 cores and 34 Dynamic Cone Penetrometer tests. The base course on both runways tested very weak, especially the top few inches. Water is filtering through the cracked asphalt and weakening the top few inches. Overall pavement strengths were low on all runway flexible features because of this weak layer. The alligator cracking on both runways verifies the pavement has been overloaded. The main runway is in POOR condition but is planned for reconstruction late this year, which includes recompacting the base. A serious problem which our lab testing revealed, however, is that the base material is moderately frost susceptible. The strength during a freeze-thaw period will be greatly reduced, even after reconstruction. The secondary runway is in VERY POOR condition and has structurallv failed due to the weak base. Only very light aircraft should operate here. The majority of taxiways and the parking apron rate VERY GOOD; however, crack sealing is required to prevent further deteriortion. Wide shrinkage cracks on the asphalt taxiways must be repaired to prevent water from washing away the base. Thin structural cracks on the concrete apron should be routed and sealed to prevent spalling. Repairing these cracks will be even more critical when the 178 TFG converts from A-7s to F-16s in 1993, since the F-16 is very FOD susceptible.

The "Runway PCN" which is to be reported in the FLIP chart for Runway 06/24 is 18/F/C/X/T. This will increase once the planned runway reconstruction project is completed in late 1992.

SECTION I: INTRODUCTION

A. Scope

1. A pavement evaluation team from HQ Air Force Civil Engineering Support Agency (AFCESA) conducted a destructive structural airfield evaluation of Springfield Air National Guard Base, Ohio, during 2-9 April 1991. The primary objectives were to:

   a. Determine in-place physical properties of the pavement structure for each feature,

   b. Compute allowable gross loadings for those features,

   c. Rate the surface condition of each feature, and

   d. Identify causes for existing or potential pavement distresses and make subsequent recommendations.

2. This report provides operations and civil engineering functions with airfield pavement strength and condition information that can be used to manage and control an airfield system. Results of pavement evaluation studies can be used to:

   a. Determine sizes, types, gear configuration, and gross weights of aircraft that can safely operate from a given airfield feature without damage to the pavements or the aircraft.

   b. Develop operations usage patterns for a particular airfield pavement system (for example parking plans, apron usage patterns, traffic flow, etc.).

   c. Project or identify major maintenance or repair requirements for an airfield to support present or proposed aircraft missions. When pavement rehabilitations are needed, it can be used to furnish engineering data to aid in the project design.

   d. Help air base mission and contingency planning functions with airfield layout and load capacity data.

   e. Develop and validate pavement system profile information.

   f. Support programming documents that justify major pavement restoration projects.

3. Many detailed appendices are used for ease of reporting the vast amount of information gathered. A description of each appendix is provided below.

Appendix	Description
A	Airfield Feature Layout Plan: Graphically depicts the different pavement features and designations of the airfield.
B	Construction History: Contains an updated construction history for the evaluated features.
C	Field Test/Core Locations and Results: Shows test pit locations and cross sections. Core locations, thicknesses and portland cement concrete (PCC) flexural strengths are documented on the core plan. Also includes dynamic cone penetrometer (DCP) test results.
D	Condition Survey and Photo Plan: Rates the surface condition of the airfield features. These ratings are a qualitative assessment based upon visual observations. The scale is the same as used in AFR 93-5. Photos and locations of significant pavement distresses are shown.
E	Summary of Physical Property Data: Physical properties of each pavement feature evaluated are tabulated in this appendix. Included are feature dimensions, material types, thicknesses of layers, and engineering properties.
F	Allowable Gross Loads (AGLs) and Pavement Classification Numbers (PCNs): A listing of the allowable magnitude of loads at four pass intensity levels for each aircraft group is shown. PCNs, a standardized method of reporting pavement strength, are also included.
G	Related Information: Included in this are climatic data, Aircraft Group Indices, Gross Weight Limits for Aircraft Groups, and Pass Intensity Levels.

B. Pavements Evaluated:

The entire active ai field at Springfield ANGB was evaluated except for the civilian apron and a few abandoned taxiways. Page A-1 in Appendix A shows the areas which were evaluated as well as those that were not.

SECTION II: BACKGROUND DATA

A. General Description of Airfield:

1. The airfield layout and feature designations are presented in Appendix A, page A-1. The type of pavement, asphaltic concrete (AC) or portland cement concrete (PCC), and its thickness are also listed here. Runway, taxiway, and apron designations are shown on page A-2.

2. Springfield-Beckley Municipal Airport has two runways, a small civilian parking apron, the larger Ohio ANG parking apron and connecting taxiways. Runway 06-24, the primary runway which the 178 TFG's A-7 aircraft use, is 9000-feet by 150-feet. Secondary Runway 15-33 is 5500-feet by 150-feet. There are two arm/dearm areas on Taxiway A. Both parking aprons are located northwest of Runway 06-24. All taxiways are 50-feet wide except for the portions of Taxiways A and B which are northeast of the ANG Apron and are 75-feet wide. All pavement is flexible except for the ANG Apron, both ends of Runway 06-24, both arm/dearm pads, and a 700-foot AC over PCC feature on Runway 06-24. The civilian apron is also AC over PCC.

B. Aircraft Traffic:

Primary aircraft using the airfield are the A-7s and light private civilian aircraft. The 178 TFG will convert from A-7s to F-16s by 1993. There is currently no commercial flights, but there is occasional private jets and 727 air-log service. Along with the A-7s, the ANG apron is used 5 to 10 times per year for transient military aircraft such as the C-130, KC-135, and C-141. A C-5 transport was brought in a few years ago and parked on the secondary runway because the ANG Apron did not have enough wing-span clearance. The frequency of these large aircraft varies greatly depending on exercises, etc.

C. Construction History:

The original airfield was built in 1946. The primary runway has been lengthened twice. It was last overlayed in 1967 and the PCC ends were completed in 1980. The arm/dearm pads were built in 1982 and the Parallel Taxiway was last overlayed in 1982. Appendix B presents a complete construction history listed by feature to include project numbers.

D. Climatic Data:

A summary of climatic data is presented in Appendix G. A narrative and climatological chart are provided. This evaluation was performed in the spring with mild temperatures and normal precipitation. The Design Freezing Index (based on the coldest year in 10) at Springfield is 600 which equates to a frost penetration depth of approximately 40 inches, using an average PCC pavement thickness of 12 inches. The Air Freezing Index (based on an average year) is 100 which equates to a frost penetration of about 19 inches from the surface.

E. Drainage:

There were no significant drainage problems apparent after several light rainfalls during the evaluation period.

SECTION III: TEST PROCEDURES

A. Field Testing

1. The evaluation team performed in situ plate bearing tests and California Bearing Ratio (CBR) tests in seven test pits located on various features throughout the airfield. In situ moisture contents and soil densities were also measured, and soil samples taken for further lab testing. The seven test pits locations are shown in Appendix C-1. Appendix C-2 shows each test pit cross section. On the cross sections are soil layer classifications and thicknesses, moisture contents at various depths, dry densities for each layer, liquid limits and plasticity indexes for the subgrades, CBR values for each layer in the flexible pits (3 thru 7) and a modulus of subgrade reaction or K-value for the rigid pits (1 and 2).

2. Field testing included extraction of 48 pavement cores. Core locations are from features throughout the airfield and are shown in Appendix C-3. The cores were sent to Tyndall AFB for analysis and testing.

3. Dynamic cone penetrometer (DCP) tests were conducted at most core locations to measure the penetration resistance of subsurface soils, which indicates soil strength variations with depth. These resistance values measured through a depth of four feet are then correlated to CBR values. The DCP locations are shown in Appendix C-3.
The results are shown in Appendix C-4 and C-5.

B. Laboratory Testing

1. Soils were classified in the laboratory in accordance with ASTM's "Standard Test Methods," using the Unified Soil Classification System (USSCS). Three grain size distribution curves are shown in Appendix E-3 for each type of soil obtained in the test pits. Samples were taken for each soil layer encountered and grouped in one of the three grain size distribution charts. Listed below the three soil group distribution charts are the specific gravity, liquid limit, plastic limit, plasticity index, frost group and classification for each layer found in the test pits.

2. PCC cores were tested for strength by tensile splitting in accordance with ASTM's "Standard Test Methods". The six-inch core tensile splitting strengths were then converted to flexural strengths using an empirical relationship (Reference 3). Flexural strengths are reported on the "Core Location Plan" (Appendix C) and in Appendix E.

SECTION IV: METHODOLOGY Of ANALYSIS

A: Physical Property Data

The parameters used for this evaluation in computing AGLs are summarized in the Summary of Physical Property Data Table, Appendix E-1 and E-2. The values presented in this table were selected as the most representative for each feature. All the test pit, coring and DCP results were analyzed along with the construction history to first determine the breakout of features and then to assign representative thickness and strength values.

B: Determination of Allowable Gross Loads (AGLs)

The AGLs were compiled by computer program based on procedures in AFM 88-24 and listed in Appendix F. AGLs were reduced 25% for those features whose condition rating was POOR or worse. The "Related Data" sheet in Appendix G aids in reading the AGL chart in Appendix F. Listed are the different Pass Intensity Levels, Aircraft Group Indicies and Gross Weight Limits for each aircraft group. An example of how this data can be used to determine the AGL for any pass level is shown below. In similar fashion, the life of a pavement feature, or number of passes to failure, can be determined for a given aircraft weight.

EXAMPLE PROBLEM

Assume the main runway has been upgraded as planned and C-141 aircraft are to operate at Springfield for an indefinite time period. Feature A2B is the preliminary parking area chosen for the C-141s. (a) Find the maximum load limit for 5,000 passes of a C-141 on this feature. (b) Assuming an operating weight of 300-kips, how many C-141 passes can be expected on this feature before failure.

SOLUTION

From the AGL table in Appendix F, the allowable gross loads for a C-141 (Group 9) on Feature A2B at Pass Intensity levels I-IV (50,000, 15,000, 3,000, and 500 passes) are 228, 254, 294, and 359-kips respectively. The weights and passes are plotted on semi-log paper as shown in Figure 1. (a) The completed graph indicates the pavement can safety support 5,000 passes of a 280-kip C-141 aircraft. (b) Also using Figure 1, a pavement life of 2500 passes can be expected for a C-141 operating weight of 300-kips.

SPRINGFIELD ANGB, FEATURE A2B
AIRCRAFT GROUP INDEX 9
C–141

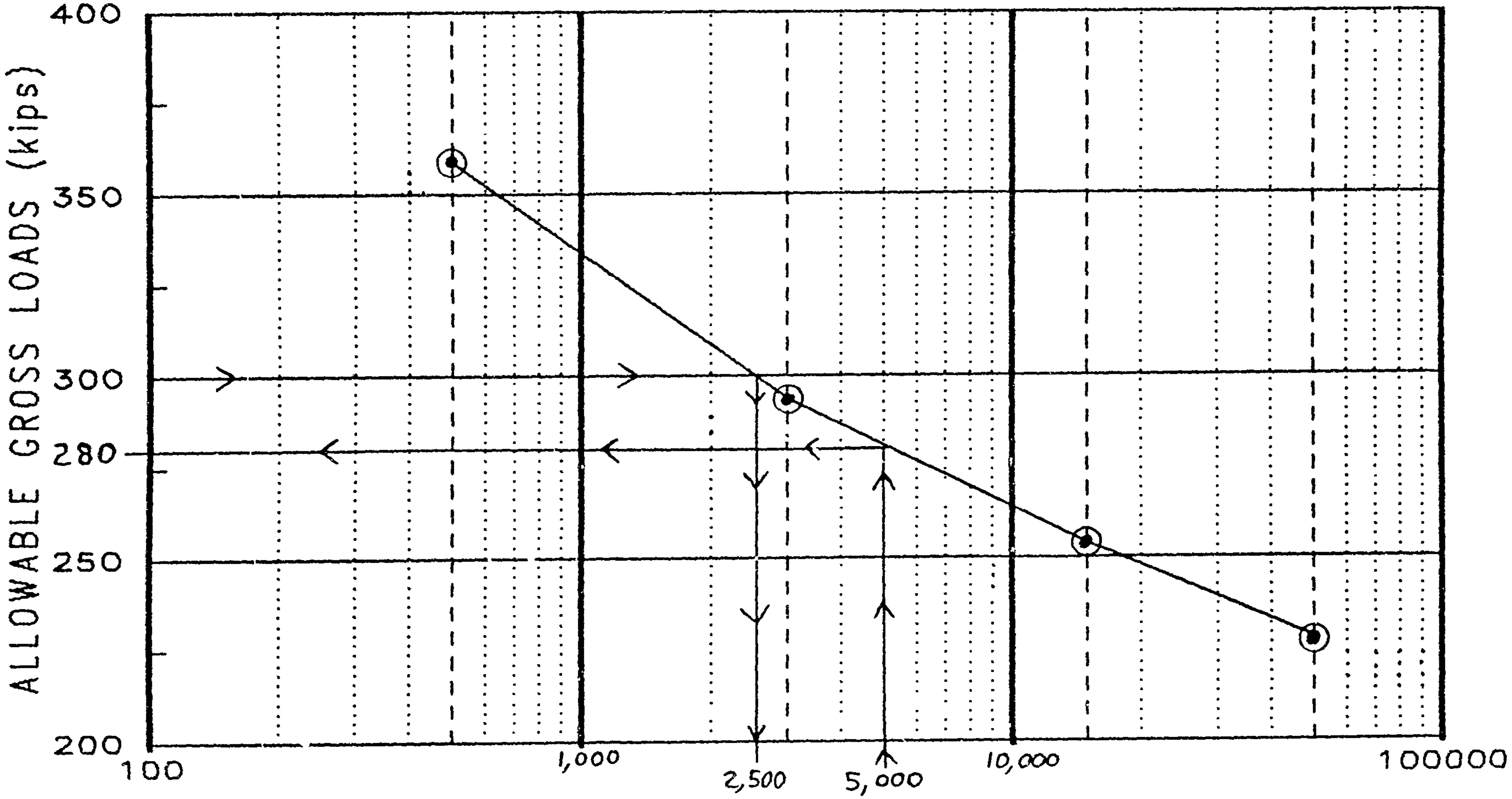

FIGURE 1

C. Pavement Classification Number

The International Civil Aviation Organization (ICAO) has developed and adopted a standardized method of reporting pavement strength. This procedure is known as the Aircraft Classification Number/Pavement Classification Number (ACN/PCN) method (Reference 4). The ACN is a number that expresses the effect an aircraft will have on a pavement. ACN values are published in References 4 and 5. The PCN is a number that expresses the capability of a pavement to support aircraft. Appendix F provides PCN values for each pavement feature. The reported PCN values are based on the AGL for Group 9 at Pass Intensity Level I (50,000 passes). Just as for AGLs, the PCNs must be based on a particular aircraft group and pass intensity level. The PCN will vary slightly depending on which aircraft group it is based upon; however, the PCNs listed should be sufficient as a guide. Fifty-thousand (50,000) passes were chosen as a standard life of a pavement. Appendix F also includes a brief explanation of the PCN nomenclature.

Theoretically, a pavement will support unlimited operations of an aircraft (beyond the standard pavement life) if the PCN is equal to or greater than the ACN. There may be situations when operators have to overload a pavement, i.e., the ACN is greater than the PCN. Pavements can usually support some overload, however, pavement life is reduced. Appendix F contains four charts that will assist the airfield manager or pavements engineer in determining how much pavement life will be reduced by overloading the pavement. An example of how these charts are used is shown below.

EXAMPLE PROBLEM

Assume Runway 06/24 has not been upgraded since this evaluation was performed. A 135-kip C-130 must make 10 passes across the weakest feature of Runway 06/24 for an excerise. How much pavement life is utilized on this weakest feature?

SOLUTION

From Appendix F, Feature R2A has a PCN of 7, which is the lowest PCN value for the Runway 06/24. The full PCN code also indicates Feature R2A is a flexible pavement over a low strength subgrade. The ACN of a 135-kip C-130 on a flexible pavement of low subgrade strength is 24. Therefore, the ACN/PCN ratio is 3.5. Using Chart #2 in Appendix F, 10 percent of the pavement life is utilized for 10 passes of an ACN/PCN ratio of 3.5 on a flexible pavement of low subgrade strength.

Chart #1 is the same format as Chart #2, but for rigid pavements. Charts #3 and #4 are also for overloading, but in a different format. For an ACN/PCN ratio of 3.5 on a flexible pavement of low subgrade strength, 100 passes can be made before the pavement fails, per Chart #4.

SECTION V: PAVEMENT ASSESSMENT

A. Overall Visual Assessment

A visual survey was conducted on all the airfield pavements to rate the surface condition for each feature. Appendix D-1, Condition Survey, shows the condition rating for each feature on an airfield map. Appendix E also lists these ratings in tabular form. These observations are not a detailed pavement condition index (PCI) as outlined in AFR 93-5 (Reference 6), however, the rating scale is the same. The ratings are based on random counts of major distresses combined with engineering judgment, with AFR 93-5 used as a guide. The visual survey could be called a "cursory PCI." Pavement condition ratings range from EXCELLENT (like new) to FAILED (unsafe for aircraft operations). They are a qualitative assessment of the pavement surface and should not be confused with the structural capacity of a pavement. For example, a pavement surface may rate EXCELLENT but have underlying pavement or soil conditions that could result in pavement failure under the applied load of a given aircraft. On the other hand, a pavement may be structurally sound but the surface condition may be hazardous for aircraft traffic (i.e. FOD). Identifying the type and severity of distresses can help provide an understanding of the pavement's response to current loads and for projecting its ability to handle future loads. Pavement conditions at Springfield ANGB range from VERY POOR to EXCELLENT. Photos were taken and are shown in Appendix D. They are referenced below.

1. Runway 06-24

Both PCC ends (Features R1A and R7A) were constructed in 1980 and are still in EXCELLENT condition. The neoprene compression seals are working well. The remainder of the AC runway features rate VERY POOR TO GOOD. These are planned for reconstruction later this year. Photos 1 through 10 show the major distresses of Runway 06-24. The two primary distresses are alligator cracking primarily in the traffic lanes, and evenly spaced transverse shrinkage cracking across the entire width.

The longitudinal alligator cracking pattern that is present along most of the centerline is shown in photos 1 and 7. Maintenance crews have poured sealant in some of these crumbling AC areas to prevent the AC from "blowing out" any further (photo 3). Alligator cracking has also developed along transverse shrinkage cracks such as shown in photos 8 and 9, where infiltrating water has weakened the base material. Photo 6 shows a longitudinal crack that has developed the same alligator crack pattern from a weakened base. The transverse shrinkage cracks are as wide as one-inch. Photos 5 and 10 show these wide cracks. Another less significant distress is the surface deterioration where paint markings have been placed (photo 2). The difference in thermal expansion of the paint and the AC causes tension stress at the interface, and thus the deterioration.

Feature R5C has PCC directly below the AC, and the joints are beginning to reflect. This feature rates FAIR. There are some significant cases of shoving where a severe transverse crack in the PCC is breaking up and shoving the AC, causing a raised lip at the surface (photo 4). Feature R4C is the worst portion of the runway and rates VERY POOR in condition. The distresses (alligator and shrinkage cracking) are the same as within Features R2A and R3C, just more severe. Features R2A and R3C rate POOR. The intersection of both runways is in slightly worse condition, possibly due to aircraft turning here.

2. Runway 15/33

All of Runway 15/33 rates VERY POOR with both block cracking (caused from the AC aging) and alligator cracking present throughout the length of the runway. The AC has oxidized and become very brittle with age. While the block cracking is consistent throughout the entire width, the alligator cracking, caused from fatique, is apparent only in the traffic lanes. This combination of block and alligator cracking is shown in photos 11, 12, and 13. Photos 12 and 13 were taken in the area where a C-5 was parked several years ago and caused severe depressions as it pulled away loaded. These depressions have since rebounded and were hardly apparent, except for the higher severity alligator or fatique cracking present in the area. The surface condition and field tests indicate this runway is all the same construction.

3. ANG Apron

The ANG Apron consists of similar Features A1B and A2B, which is a 150-foot wide extension of A1B. Both rate VERY GOOD and are six-inch PCC overlays unbonded (one-inch of AC) to the original 12-inch (A1B) or 10-inch (A2B) PCC. Photo 16 shows test pit #1 and the six-inch and 12-inch PCC layers. Structural distresses such as corner breaks and transverse cracks are most common at the throat, where all traffic must pass (photos 14 and 15). These low severity cracks should be routed and sealed soon before spalling occurs. Some transverse cracks are propagating to adjacent slabs.

4. Taxiways

Taxiway G leading into the ANG Apron rates VERY GOOD with low severity transverse shrinkage cracks (photo 17) and very thin paving lane cracks. The transverse cracks are greater than 1/4-inch wide and thus should be routed and sealed. The paving lane cracks are less than a 1/4-inch wide. However, sealing them now will greatly slow down their deterioration and water infiltrating into the base.

The PCC arm/dearm pads rate EXCELLENT with only low severity joint seal damage and hairline surface cracking. The sealant is pulling away from the PCC and is missing in areas on the north pad. The hairline cracks are only visible when the pavement is wet (photo 18) and were probably caused from the PCC curing too fast.

Taxiways A, B, C, and F rate VERY GOOD and are most often used by the ANG. The other taxiways are rarely used. Taxiway A has had its low severity paving lane cracks sealed which will greatly deter them from getting worse (photo 25). Very fine transverse cracks which are only apparent when the AC is damp are shown in two areas in photos 21 and 22. These were caused from either laying the AC down too hot and causing it to stick to the screed or rolling the AC when it was too hot. Rolling the AC does not completely take these cracks out. Taxiways B has low severity paving lane cracks and transverse shrinkage cracks which should be routed and sealed soon (photo 24). Taxiway C has only low severity transverse shrinkage cracks (photo 23) that should be repaired quickly. Taxiway F has only medium severity transverse cracks regularly spaced every 50-feet which are up to 1/2-inch wide (photo 19). They must be routed and sealed soon. Test Pit #7 was located in Taxiway A adjacent to the Civilian Apron. PCC was found directly under the AC in half the pit. The pit was excavated right at the transition where the old PCC apron met the flexible taxiway. Taxiway A had been widened to include a portion of this AC over PCC feature. Photo 20 shows the test pit and transition joint. Taxiways D, E, and H rate FAIR, suffer from heavy block cracking and are rarely used. They have transverse shrinkage cracks which are depressed from base failure or washout. Some utility cuts are also low.

B. Field Tests

1. Both runways had very weak bases. Test pits #5 and #6 on Runway 15/33 had CBR values of 4 and 13 respectively. Test pits #3 and #4 on Runway 06/24 had CBR values of 19 and 13 respectively. With only 3.5 to 6 inches of AC on these flexible runway features, this weak base layer controls structurally and is the cause for the low AGLs and PCNs. The final representative CBR values selected for the bases were 30 for Runway 06/24 and 20 for Runway 15/33. They were increased due to the DCP tests which show the CBR values to only be very low for the top few inches of base, and then they steadily increase. The CBR tests performed in the test pits were all done at the top of the base layer where it is weakest. The DCP CBR values only match the actual CBR tests at the first few inches of base. All four test pits were located where the pavement was badly cracked and water undoubtedly has infiltrated and weakened the top of the base.

2. A macadam base was found in both core holes in Feature R4C. It was six inches thick. This feature rated VERY POOR and had more alligator cracking than the rest of the runway. It is possible the macadem is less stable than the other base and is the reason for the worse condition. Removing the macadam should be considered during the runway rehab project, since the plan calls for the base to be recompacted. It is also possible to blend the pulverized AC into the existing macadam and make it more stable.

C. Laboratory Tests

1. Lab testing revealed all base course material was frost susceptible and grouped as F2. The six Frost Groupings are S1, S2, F1, F2, F3, and F4 with F4 being the worse. When evaluating for freeze-thaw conditions, a CBR value of 6.5 is given to F2 soil. This obviously makes all flexible features very weak during the freeze-thaw cycle and is explained more in Section V.4. The base material was actually a high F2, meaning it is closer to a F-3 than a F-1. All subgrade samples were grouped as a F-3 or F-4. Appendix E-3 shows each sample's frost grouping.

2. The subgrade samples shown as Soils Group "B" on Appendix E-3 classify as a lean clay. The base courses shown as Soils Groups "A" and "C" predominately classify as a silty sand.

D. Summary of Allowable Gross Loads

1. The AGLs are listed in Appendix F for each feature. The

Related Data Table in Appendix G is needed to read and understand the AGL table. It describes the different Aircraft Group Indices and Pass Intensity Levels. An "A" on the AGL table indicates the AGL is below the lowest possible gross weight of any aircraft in that group. The "+" on the AGL table indicates the AGL is higher than the maximum weight of any aircraft in that group.

2. Pass Intensity Levels 5 and 6 on the AGL chart are used to show the reduced AGLs during the freeze-thaw period. The number of passes are the same as Pass Intensity Levels 1 and 2, but during the freeze-thaw period. As the AGL chart indicates for Pass Intensity Levels V and VI, most of the flexible features are structurally inadequate for even the lightest aircraft during the freeze-thaw period. This is due to the base being assigned a CBR value of 6.5 because it was grouped as a F2.

SECTION VI: CONCLUSIONS/RECOMMENDATIONS

A. General Comments

1. A major project is planned for the AC portion of Runway 06/24 which includes milling all the AC, recompacting the base, using the milled AC as a new base and overlaying with 4-inches of new AC. This design should work well except that it does not resolve the problem of a frost susceptible base. The current design will increase the strength during the freeze-thaw period, but not to the degree needed. Calculations were performed to see how many F-16 passes could be obtained with the current design of 4 inches of AC over 5 inches of pulverized AC over a frost susceptible base. Four cases are summarized below:

Load (Kips)	Base Frost Grouping	Base CBR	Allowable Passes
35	F2	6.5	540
30	F2	6.5	980
35	F1	9.0	4500
30	F1	9.0	2140

In all cases, the weak 9-inch thick base controlled over the weaker subgrade, which had a CBR of 3.5 assigned since it is grouped as a F3 or F4. Because the base is a high F2, the last two cases should not be considered.

2.. The design for the planned runway project assumes a subgrade CBR of 6, which is the value we obtained thru field tests. The design, using FAA guidelines, called for 25 inches of cover over the subgrade. This was checked using Air Force design guides and matched.

3. The same design does not mention the macadam base material in feature R4C. Replacing this material or blending in the pulverized AC should be considered to increase its stability. At the very least, the contractor should be made aware of its presence.

4. The top few inches of base on both runways is very weak, as reflected by the CBR tests performed at the top of the base and the DCP tests conducted thru the base. The strength increases several inches into the base. Infiltrating water through the cracked pavement has surely weakened the base. Section V.B discusses the results further. Recompacting the base as planned with the upcoming project is definitely needed, but does not address the freeze-thaw problem.

Specific Conclusions/Recommendations

1. The cracks in the ANG Apron should be routed and sealed. The PCC will spall if left unattended.

2. The transverse shrinkage cracks in Taxiways A, B, C, G, and F should be routed and sealed ASAP. Backer rod will be required if the crack is wider than 3/4-inch. The AFCESA Asphalt Crack Repair Field Manual will be sent to the 178 TFG/DE and should be helpful.

3. Paving lane cracks in Taxiway B and Taxiway G are less than an 1/8-inch wide. Sealing them now, just as Taxiway A was done, will greatly deter the cracks from getting worse.

4. Seal the few joints in the north Arm/Dearm Pad that have no sealant. This feature (T12A) will require joint resealing in a few years.

GLOSSARY

Allowable Gross Load (AGL) - The maximum aircraft load that can be supported by a pavement feature for a particular number of passes.

Base or Subbase Courses - Natural or processed materials placed on the subgrade beneath the pavement.

Compacted Subgrade - The upper part of the subgrade, which is compacted to a density greater than the portion of the subgrade below.

Feature - A unique portion of the airfield pavement distinguished by traffic area, pavement type, pavement surface thickness and strength, soil layer thicknesses and strengths, construction period, and surface condition.

Frost Evaluation - Pavement evaluation during the frost-melting period, when the pavement load-carrying capacity will be reduced unless protection has been provided against detrimental frost action in underlying soils. Pass Intensity Levels V and VI are used with reduced subgrade strengths to determine the maximum allowable loads during the frost-melt period.

Pass - On a runway, the movement of an aircraft over an imaginary line 500 feet down from the approach end. On a taxiway, the movement of an aircraft over an imaginary line connecting an apron with the runway. AFR 93-5, Chapter 2.

Pass Intensity Levels (PIL) - Specific repetitions of aircraft over a pavement feature, regardless of time, that are dependent on aircraft design category. AFR 93-5, Chapter 2.

Pavement Condition Index (PCI) - A numerical indicator between 0 and 100 that reflects the surface operational condition of the pavement. AFR 93-5, Chapter 3.

Primary Pavements - Those features that are absolutely necessary for mission aircraft operations. AFR 93-5, Chapter 4.

Subgrade - The natural soil in-place, or fill material, upon which a pavement, base, or subbase course is constructed.

Type A Traffic Areas - Type A Traffic Areas are those pavement facilities that receive the channelized traffic and full design weight of the aircraft. AFM 88-6, Chapter 1.

Type B Traffic Areas - Type B Traffic Areas are considered to be those areas where traffic is more nearly uniform over the full width of the pavement facility, but which receive the full design weight of the aircraft. AFM 88-6, Chapter 1.

Type C Traffic Areas - Type C Traffic Areas are considered to be those on which the volume of traffic is low or the applied weight of the operating aircraft is less than the design weight. AFM 88-6, Chapter 1.

PAVEMENT CONDITION EVALUATION TERMINOLOGY

CONDITION RATING	DEFINITION
EXCELLENT	PAVEMENT HAS MINOR OR NO DISTRESS AND WILL REQUIRE ONLY ROUTINE MAINTENANCE.
VERY GOOD	PAVEMENT HAS SCATTERED LOW SEVERITY DISTRESSES WHICH SHOULD NEED ONLY ROUTINE MAINTENANCE.
GOOD	PAVEMENT HAS A COMBINATION OF GENERALLY LOW AND MEDIUM SEVERITY DISTRESSES. MAINTENANCE AND REPAIR NEEDS SHOULD BE ROUTINE TO MAJOR IN THE NEAR-TERM.
FAIR	PAVEMENT HAS LOW, MEDIUM, AND HIGH SEVERITY DISTRESSES WHICH PROBABLY CAUSE SOME OPERATIONAL PROBLEMS. MAINTENANCE AND REPAIR NEEDS SHOULD RANGE FROM ROUTINE TO RECONSTRUCTION IN THE NEAR-TERM.
POOR	PAVEMENT HAS PREDOMINANTLY MEDIUM AND HIGH SEVERITY DISTRESSES CAUSING CONSIDERABLE MAINTENANCE AND OPERATIONAL PROBLEMS. NEAR-TERM MAINTENANCE AND REPAIR NEEDS WILL BE INTENSIVE.
VERY POOR	PAVEMENT HAS MAINLY HIGH SEVERITY DISTRESSES WHICH CAUSE OPERATIONAL RESTRICTIONS. REPAIR NEEDS ARE IMMEDIATE.
FAILED	PAVEMENT DETERIORATION HAS PROGRESSED TO THE POINT THAT SAFE AIRCRAFT OPERATIONS ARE NO LONGER POSSIBLE. COMPLETE RECONSTRUCTION IS REQUIRED.

CONVERSION FACTORS

BRITISH TO INTERNATIONAL SYSTEMS (SI) OF UNITS

British units of measurements are used in this report and can be converted to SI (Metric) units as follows:

TO CONVERT	TO	MULTIPLY BY
LENGTH		
inch (in)	millimetre (mm)	25.400
inch (in)	metre (m)	0.0254
foot (ft)	metre (m)	0.305
yard (yd)	metre (m)	0.915
mile (mi)	kilometre (km)	1.609
AREA		
square inch (in^2)	square millimetre (mm^2)	645.2
square inch (in^2)	square metre (m^2)	0.0006452
square foot (ft^2)	square metre (m^2)	0.093
square yard (yd^2)	square metre (m^2)	0.8361
square mile (mi^2)	square kilometres (km^2)	2.59
acres	square kilometres (km^2)	0.004046
VOLUME		
cubic inch (in^3)	cubic millimetre (mm^3)	16487.0
cubic foot (ft^3)	cubic metre (m^3)	0.028
cubic yard (yd^3)	cubic metre (m^3)	0.7646
MASS		
pound (lb)	kilogram (kg)	0.454
FORCE		
pound (lb f)	newton (n)	4.448
kip (1000 lb f)	kilogram (kg)	453.6
STRESS		
pound per square inch (psi)	kilo Pascals (kPa)	6.895
MODULUS OF SUBGRADE REACTION (K-VALUE)		
pounds per square inch per inch (psi/in)	kilo Pascals per millimetre (kPa/mm)	0.2715
DEGREES		
degrees Fahrenheit(^{o}F) (F^{o}-32)	degrees Celsius (^{o}C)	5/9
DENSITY		
pounds per cubic foot (pounds mass)	kilogram per cubic meter (kg/m^3)	16.052

REFERENCES

1. AFM 89-3, Materials Testing, August 1987

2. AFR 93-13, Airfield Pavement Evaluation Program, Febuary 1990

3. Hammitt, G. M. III, Concrete Strength Relationships, Research Paper, Texas A&M University, College Station, Texas, December 1971

4. FAA Advisory Circular 150/5335-5, Standardized Method of Reporting Airport Pavement Strength - PCN, 15 June 1983

5. Airfield Pavement Design and Evaluation Curves, Air Force Engineering and Services Center, Tyndall AFB FL, January 1991

6. AFR 93-5, Procedure for US Army and US Air Force Airfield Pavement Condition Survey, July 1989

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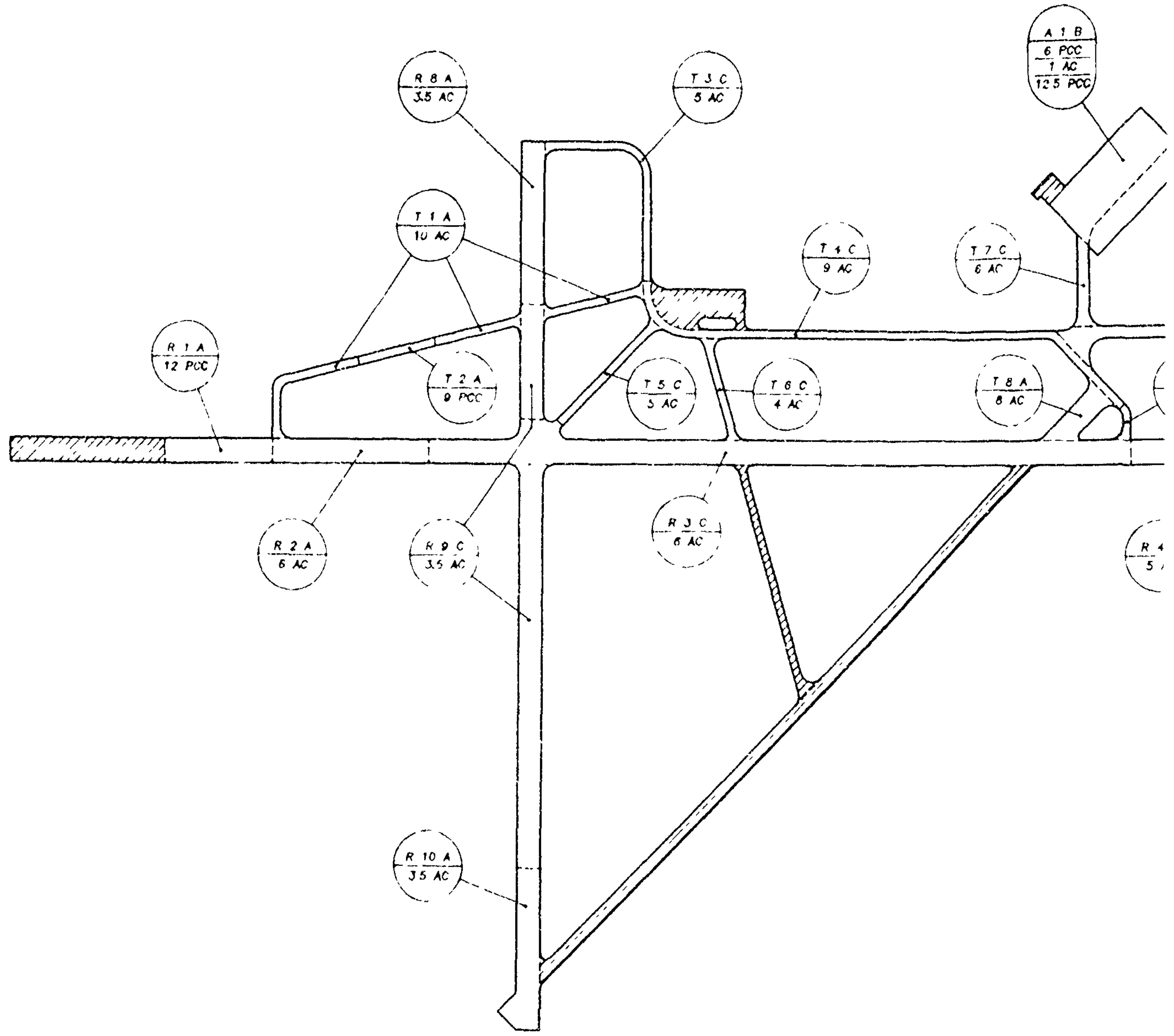
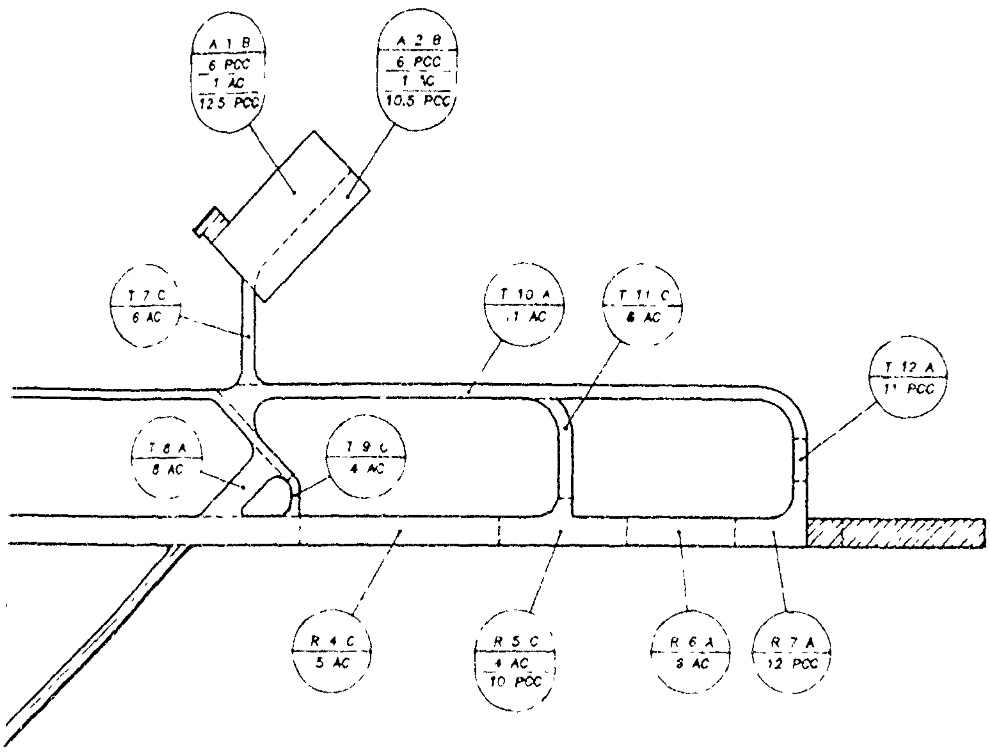


A 1 B
6 PCC
1 AC
12.5 PCC
R 8 A
3.5 AC
T 3 C
5 AC
T 1 A
10 AC
T 4 C
9 AC
T 7 C
6 AC
R 1 A
12 PCC
T 2 A
9 PCC
T 5 C
5 AC
T 6 C
4 AC
T 8 A
8 AC
R 2 A
6 AC
R 9 C
3.5 AC
R 3 C
6 AC
R 10 A
3.5 AC



LEGEND

P 2 A — FEATURE DESIGNATION (SEE NOTE 1)
13 PCC — PAVEMENT THICKNESS IN INCHES & TYPE

TYPE OF FEATURE

- R – RUNWAY
- T – TAXIWAY
- A – APRON
- O – OVERRUN

TYPE TRAFFIC AREA (SEE NOTE 2)

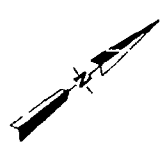
- A – A TYPE TRAFFIC
- B – B TYPE TRAFFIC
- C – C TYPE TRAFFIC

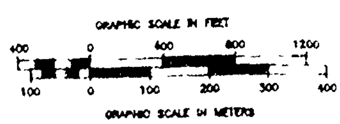
- - - - CHANGE IN FEATURE DESIGNATION
AC ASPHALTIC CONCRETE
PCC PORTLAND CEMENT CONCRETE

NOT EVALUATED

NOTES

1. FEATURE DESIGNATION DENOTES TYPE OF FEATURE, NUMBER OF FEATURE FOR GIVEN FEATURE TYPE AND TYPE TRAFFIC AREA.
2. TRAFFIC AREA DESIGNATIONS ARE BASED ON AFM 88-6, CHAP 1.
3. FEATURE DESIGNATIONS DO NOT CORRESPOND WITH THOSE FROM PREVIOUS REPORTS AND DRAWINGS.





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AIRFIELD LAYOUT PLAN

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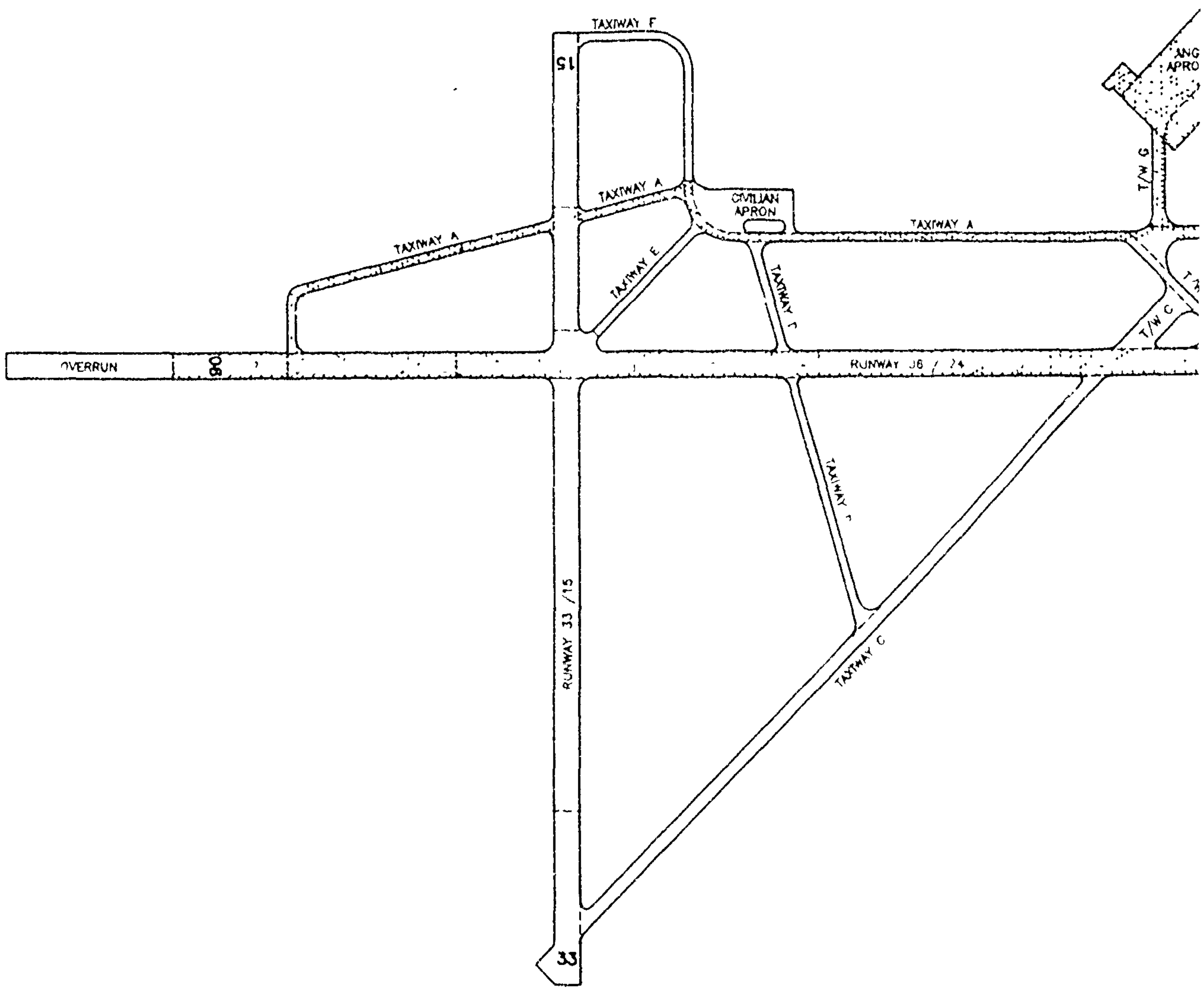
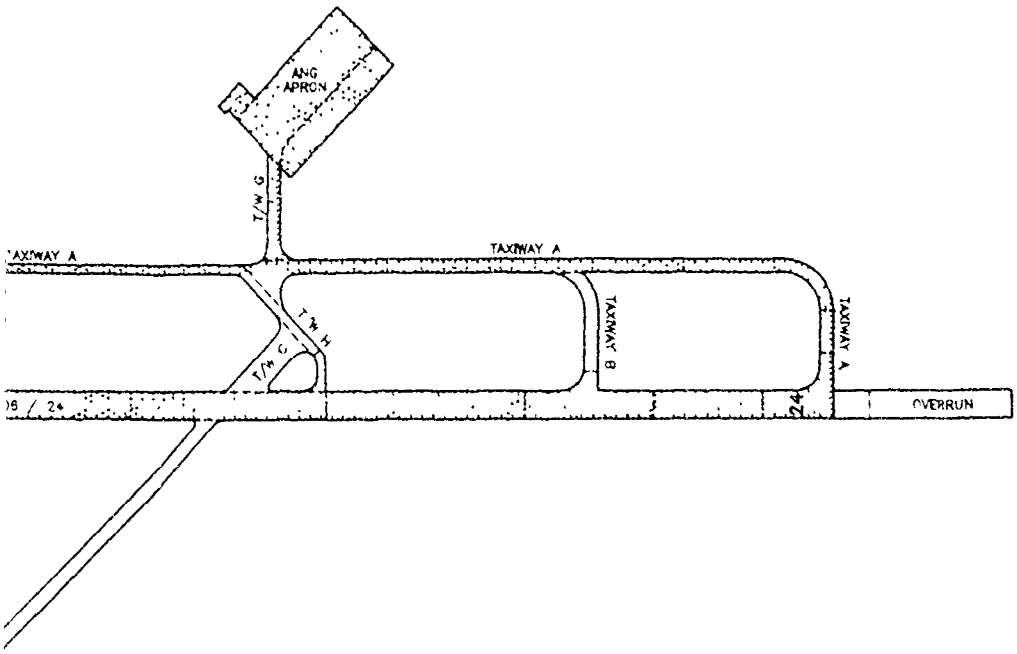

TAXIWAY F
15
TAXIWAY A
TAXIWAY A
CIVILIAN APRON
TAXIWAY A
T/W G
TAXIWAY E
TAXIWAY F
T/W C
OVERRUN
08
RUNWAY 06 / 24
TAXIWAY F
RUNWAY 33 /15
TAXIWAY C
33



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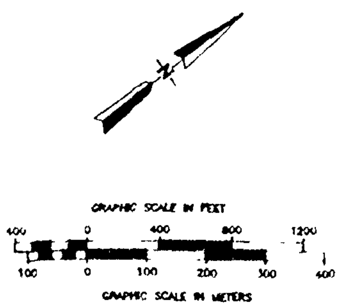
PRIMARY PAVEMENTS



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AIRFIELD DESIGNATIONS & PRIMARY PAVEMENTS

SPRINGFIELD AIR NATIONAL GUARD BASE, OHIO

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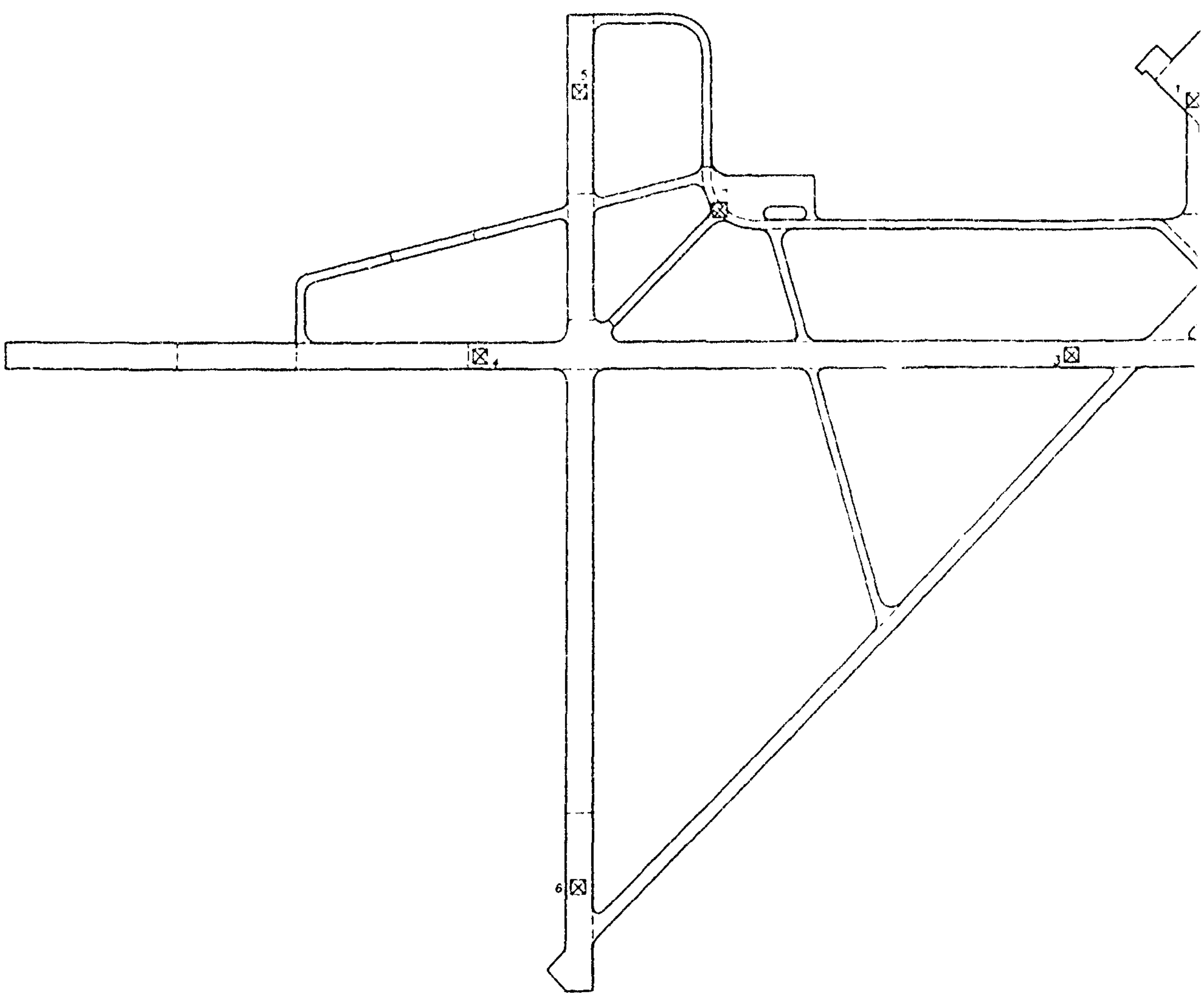
CONSTRUCTION HISTORY

SPRINGFIELD ANG BASE OH.

FEATURE DESCRIPTION		APPROXIMATE CONSTRUCTION PERIOD	TYPE & THICKNESS IN INCHES	REMARKS
R01A	RUNWAY-06 STA 0+00 TO 7+00	1985	12 PCC	COE RECONSTRUCTION ANG PROJ 33-85-R-0001 REMOVE AND REPLACE WITH 11"BC and 12" PCC
R02A	RUNWAY-06 STA 7+00 TO 17+00	1947 1954	3 AC 2 AC	COE ORIGINAL CONSTRUCTION PROJ. 78-08-01 OVERLAY 75' KEEL
R03C	RNWY 06-24 STA 17+00 TO 47+00	1947 1954	3 ACC 2 AC	USCOE ORIGINAL RECONSTRUCTION PROJ 78-08-01 OVERLAY 75' KEEL
R04C	RNWY 06-24 STA 47+00 TO 58+00	1954 UNK	3 AC 2 AC	USCOE ORIGINAL CONSTRUCTION PROJ. 78-08-01 UNK
R05C	RNWY 24 STA 58+00 TO 65+00	1954 1958 UNK	10 PCC 4 AC	USCOE ORIGINAL CONSTRUCTION PROJ. 78-08-01 USCOE PROJ.AW 86-04-01 ADD 300'PCC OVERRUN UNK
R06A	RNWY 24 STA 65+00 TO 71+00	1962 unk	3 AC 3 AC	600' RW EXT. COE AW-86-04-02 UNK
R07A	RNWY 24 STA 71+00 TO 75+00	1962 1985	10 PCC 12 PCC	400' RW EXT. COE AW 86-04-02 OHIO ANG PROJ 33-85-R-0001 REMOVE EXISTING PCC REPLACE WITH 11" BASE 12" PCC.
R08A	RNWY 15 STA 0+00 TO STA 10+00	1947	3 AC	COE ORIGINAL CONSTRUCTION
R09C	RNWY 15-33 STA 10+00 TO 45+50	1947	3 AC	COE ORIGINAL CONSTRUCTION
R10A	RNWY 33 STA 45+50 TO 56+00	1947	3 AC	COE ORIGINAL CONSTRUCTION
T01A	RNWY 06 ACCESS	1947 1954 1982	3 AC 2 AC 6 AC	COE ORIGINAL CONSTRUCTION PROJ. 78-08-01 OVERLAY 25' KEEL 3" LEVELING COURSE WITH 3" SURFACE COURSE
T02A	SW ARM/DEARM AREA	1982	9 PCC	REMOVE EXISTING PAVEMENT RECOMPACT AND INSTALL NEW PCC
T03C	RNWY 15 ACCESS	1947 UNK	3 AC 2 AC	COE ORIGINAL CONSTRUCTION UNKNOWN
T04A	PARALLEL TXWY	1947 1954 1982	3 AC 2 AC 6 AC	COE ORIGINAL CONSTRUCTION PROJ. 78-08-01 OVERLAY 25' KEEL 3" LEVELING COURSE WITH 3" SURFACE COURSE
T05C	TAXIWAY ACCESS AT RUNWAY INTERSECTION	1947 1954	3 AC 2 AC	COE ORIGINAL CONSTRUCTION PROJ. 78-08-01 OVERLAY 25' KEEL
T06C	APRON ACCESS TXWY	1947 UNK	3 AC 1 AC	COE ORIGINAL CONSTRUCTION UNKNOWN
T07A	ANG APRON ACCESS	1954 1982	3 AC 3 AC	COE ORIGINAL CONSTRUCTION PROJ 78-08-01 OVERLAY ASSUMED AS PART OF 82' OVERLAY PROJ
T08A	APRON ACCESS FROM RNWY 06-24	1947 1982	3 AC 5 AC	COE ORIGINAL CONSTRUCTION OVERLAY ASSUMED AS PART OF 82' OVERLAY PROJ
T09C	RNWY ACCESS TXWY	1947 UNK	3 AC 1 AC	COE ORIGINAL CONSTRUCTION POSSIBLY 1954 RNWY EXTENTION PROJ 78-08-01
T10A	PARALLEL TXWY	1954 1982	3 AC 6 AC	COE ORIGINAL CONSTRUCTION PROJ 78-08-01 3" LEVELING COURSE WITH 3" SURFACE COURSE

T11C	RUNWAY ACCESS	1954	3 AC	COE ORIGINAL CONSTRUCTION PROJ 78-08-01
		UNK	6 AC	3" LEVELING COURSE WITH 3" SURFACE COURSE
T12A	RNWY 24 ACCESS	1962	10 PCC	COE ORIGINAL CONSTRUCTION PROJ AW-86-04-02
		1985	12 PCC	PROJ 33-85-R-0001 REMOVE/REPLACE WITH 12 PCC
A01B	ANG APRON	1954	12 PCC	COE PROJ 78-08-01 CONST. 830' x 300' APRON
		1976	6 PCC	ANG PROJ. 74-21 1" AC BOND BREAKER OVERLAY WITH 6"PCC.
A02B	ANG APRON	1958	10 PCC	COE AW 86-04-01 155'x 830' APRON EXPANSION
		1976	6 PCC	ANG PROJ. 74-21 1" AC BOND BREAKER OVERLAY WITH 6" PCC.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4
3
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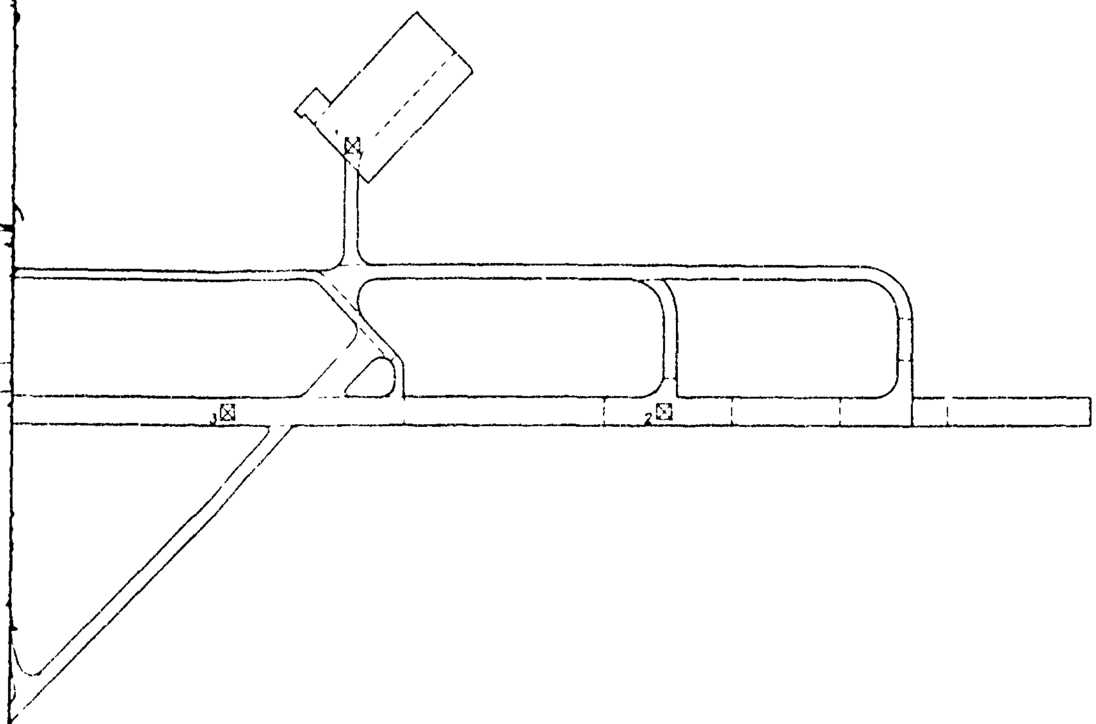

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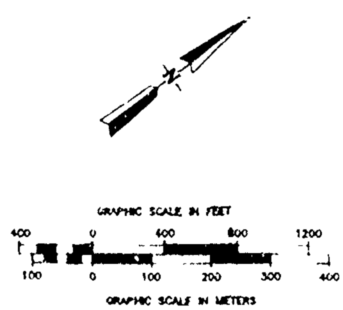
⊠₃ TEST PIT LOCATION AND NUMBER



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TEST PIT LOCATIONS

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C—1

A 1 B

TEST PIT 1								
DEPTH (in)	MATERIAL SYMBOL	MATERIAL CLASSIF	ω (%)	γd (pcf)	CE 55 %COMP	CE 55 OMC	LL/PI (%)	K (psi/in)
		AC						
6.0 / 7.0		PCC						
19.0		CL-ML		129.5			21 1/ 6.2	120
24.0			10.3					
36.0			12.3					
48.0			12.6					
60.0			13.3					

COMMENTS:
1 INCH BOND BREAKER BETWEEN AC AND PCC.

R 5 C

TEST PIT 2								
DEPTH (in)	MATERIAL SYMBOL	MATERIAL CLASSIF.	ω (%)	γd (pcf)	CE 55 %COMP	CE 55 OMC	LL/PI (%)	(psi/in)
3.5		AC						
		PCC						
7.0		GM	7.5	136.7			NP	250
23.0 / 24.0		CL	9.2				34.2/ 16.7	
36.0			13.8					
48.0			13.6					
		CL					41.4/ 20.8	
60.0			22.8					

DEPTH (in)
5.0
12.0
19.0
24.0
27.0
36.0
48.0
60.0

R 8 A

TEST PIT 5								
DEPTH (in)	MATERIAL SYMBOL	MATERIAL CLASSIF.	ω (%)	γd (pcf)	CE 55 %COMP	CE 55 OMC	LL/PI (%)	CBR
		AC						
3.5 / 8.0		SM		132.3			NP	4
12.5		SM	10 3	133.8			NP	30
17.0 / 21.0		SM	10.3	136.9			NP	18
25.0		CL	10.3	122.0			32.7/ 12.5	5
36.0			14.9					
48.0			17.1					
60.0			12.2					

R 10 A

TEST PIT 6								
DEPTH (in)	MATERIAL SYMBOL	MATERIAL CLASSIF.	ω (%)	γd (pcf)	CE 55 %COMP	CE 55 OMC	LL/PI (%)	CBR
		AC						
4.0		SM	6.6	139.0			NP	13
12.5		SM					NP	13
21.0 / 24.0		SM	14.2				NP	13
26.0		CL		121.3			40.4/ 20.4	1
36.0			13.6					
48.0			14.7					
60.0			15.5					

DEPTH (in)
8.5
14.0
23.0
36.0

COMME
TEST
SG

55		LL/PI	K
P	OMC	(%)	(psi/in)
		NP	250
		34.2/ 16.7	
		41.4/ 20.8	

R 3 C

TEST PIT 3

DEPTH (in)	MATERIAL SYMBOL	MATERIAL CLASSIF	ω (%)	γd (pcf)	CE 55 %COMP	CE 55 OMC	LL/PI (%)	CBR
		AC						
5.0		SM	6.2	134.0			NP	19
12.0			7.6					
19.0		SW-SM		114.1			NP	9
24.0			14.8					
27.0		CL		113.1			46.3/ 25.5	6
36.0			17.2					
48 0			14.9					
60.0			25 2					

R 3 C

TEST PIT 4

DEPTH (in)	MATERIAL SYMBOL	MATERIAL CLASSIF	ω (%)	γd (pcf)	CE 55 %COMP	CE 55 OMC	LL/PI (%)	CBR
		AC						
6.0		SM		138.2			NP	13
12.0			10.2					
15.0		SM		136.2			NP	27
21.0		SP-SM		130.1			NP	9
24 0			13.2					
27.0		CL		132.2			28.2/ 17.6	4
36.0			13.3					
48.0			13.4					
60.0			12.8					

55		LL/PI	CBR
	OMC	(%)	
		NP	13
		NP	13
		NP	13
		40.4/ 20.4	1

T 4 C

TEST PIT 7

DEPTH (in)	MATERIAL SYMBOL	MATERIAL CLASSIF.	ω (%)	γd (pcf)	CE 55 %COMP	CE 55 OMC	LL/PI (%)	CBR
		AC						
8.5		SM		132.1			NP	100+
14.0			13.5					
			8.8	138.8				
23.0		SM	11.8	120.2				21
36.0		CL						

COMMENTS:
TEST OF SUBGRADE NOT PRFORMED DUE TO RAIN
SG IS THE SAME AS TEST PIT 4 AND 5.

UNIFIED SOIL CLASSIFICATION

SP	POORLY GRADED SAND
SW-SM	WELL-GRADED SILTY SAND
SP-SM	POORLY GRADED SILTY SAND
SM	SILTY SAND
CL	LEAN CLAY (LOW TO MEDIUM PLASTI
CL-ML	SILTY CLAY (LOW TO MEDIUM PLASTI

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TEST PIT CROSS SECTI

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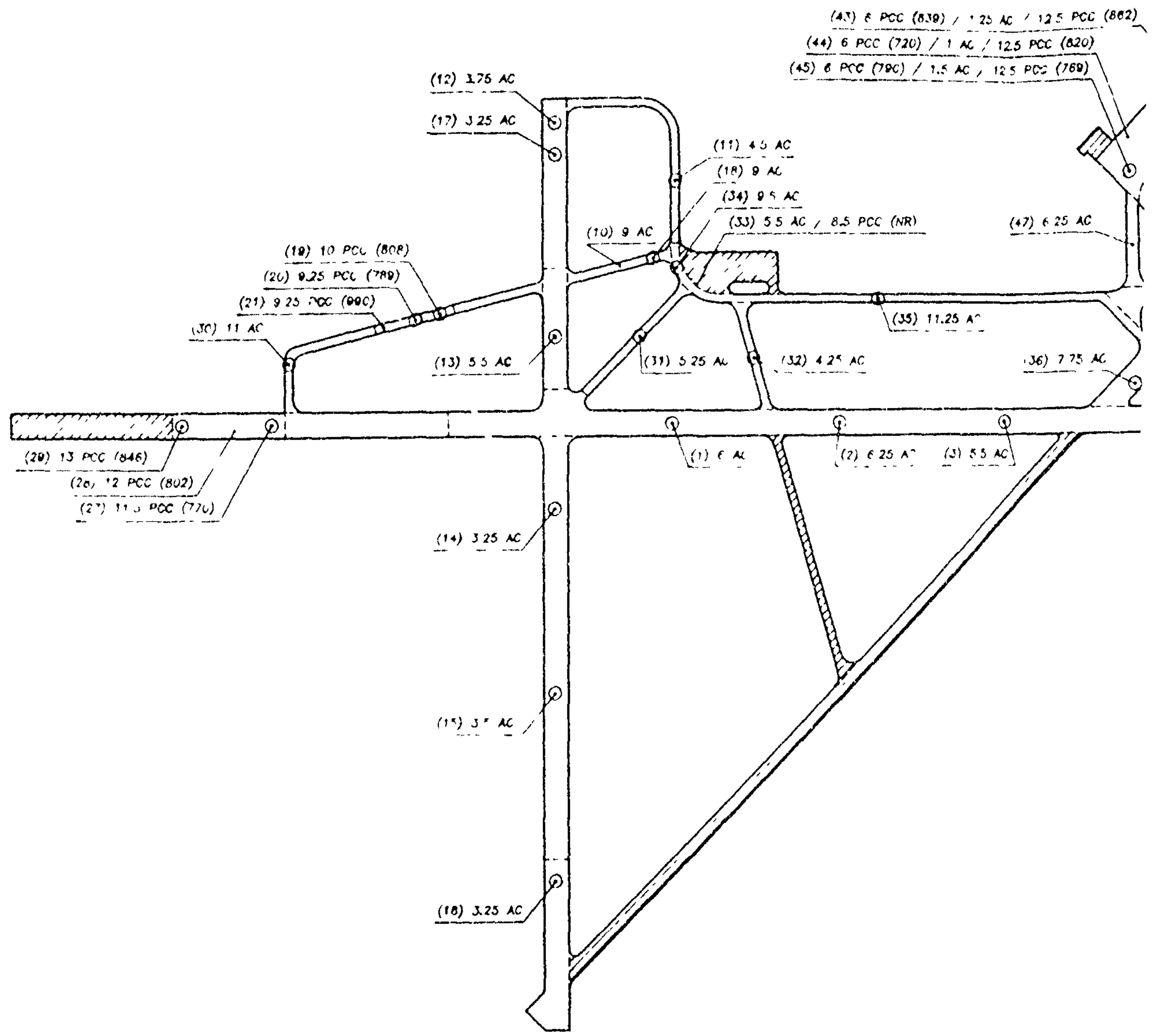
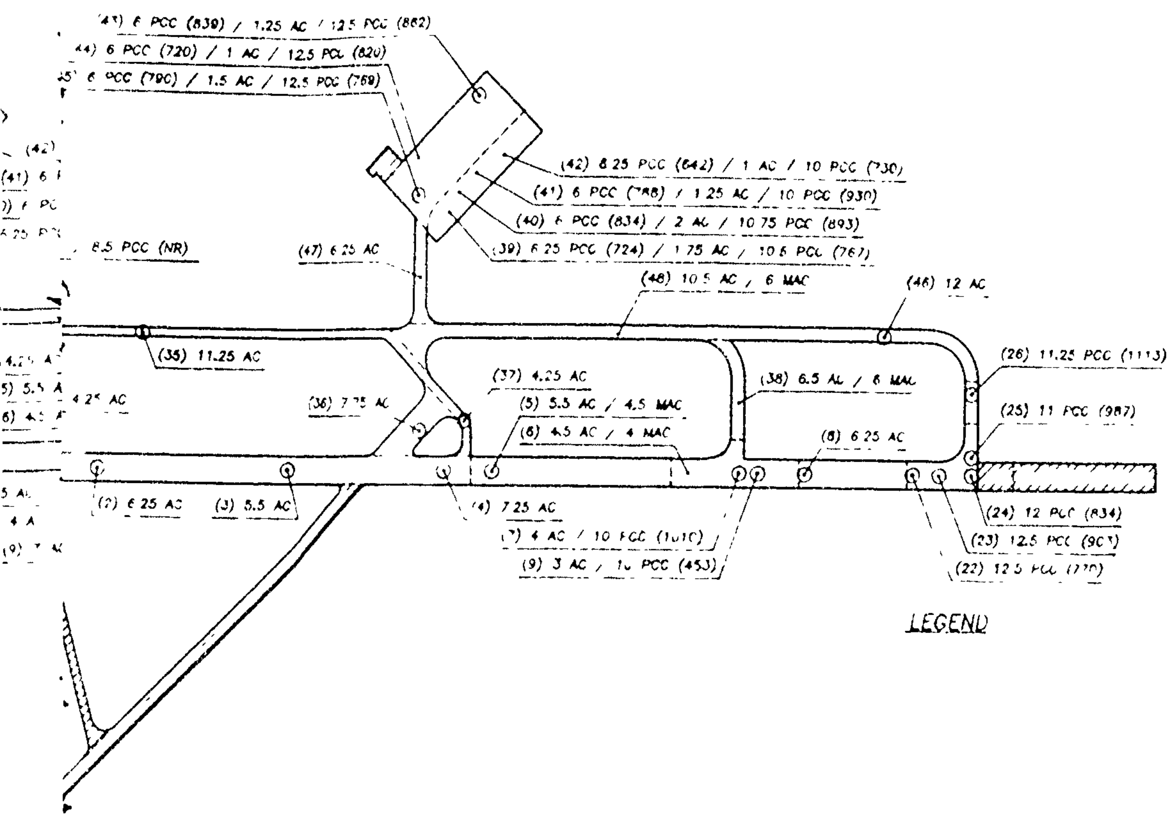


(44) 6 PCC (720) / 1 AC / 12.5 PCC (820)
(45) 6 PCC (79C) / 1.5 AC / 12.5 PCC (769)
(12) 3.75 AC
(17) 3.25 AC
(11) 4.5 AC
(18) 9 AC
(34) 9.5 AC
(33) 5.5 AC / 8.5 PCC (NR)
(47) 6.25 AC
(10) 9 AC
(19) 10 PCC (808)
(20) 9.25 PCC (789)
(30) 11 AC
(35) 11.25 AC
(13) 5.5 AC
(31) 5.25 AC
(32) 4.25 AC
(36) 7.75 AC
(29) 13 PCC (846)
(1) 6 AC
(2) 6.25 AC
(3) 5.5 AC
(14) 3.25 AC
(18) 3.25 AC



LEGEND

(25) 4 AC / 10 PCC (824)
CORE LOCATION, CORE NUMBER, PAVEMENT T
IN INCHES, PAVEMENT TYPE AND FLEXURAL S
OF CONCRETE FOR PCC CORES

○ DYNAMIC CONE PENETROMETER (DCP) TEST L

AC ASPHALTIC CONCRETE

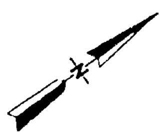
PCC PORTLAND CEMENT CONCRETE

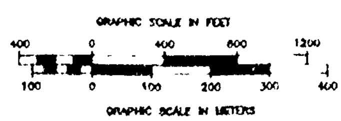
MAC MACADAM

(NR) NOT RECOVERED

(NT) NOT TESTED

NOT EVALUATED





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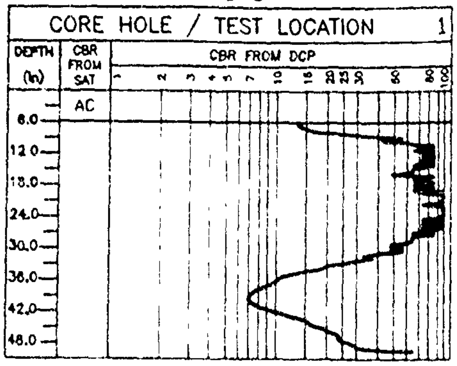
C–3

R 3 C



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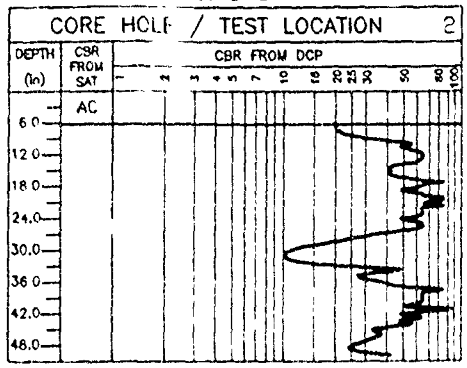

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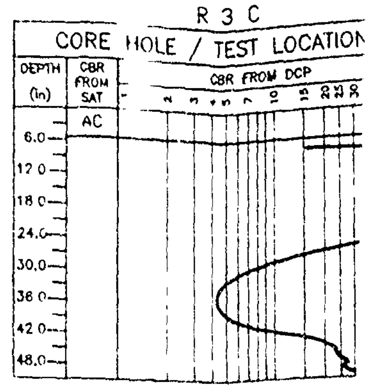

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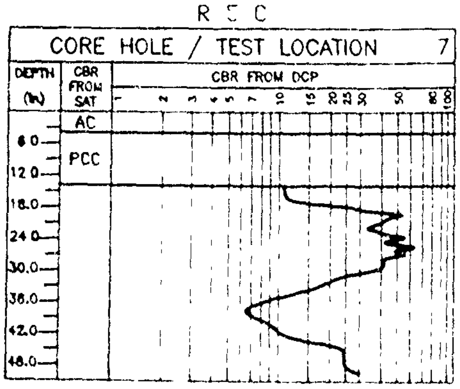

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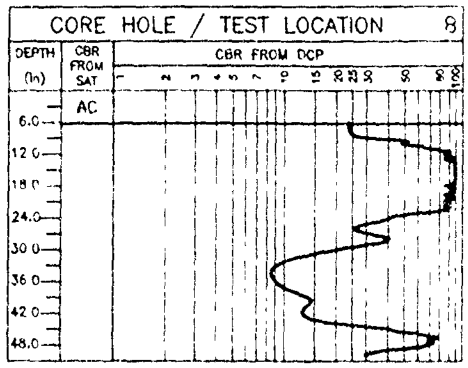

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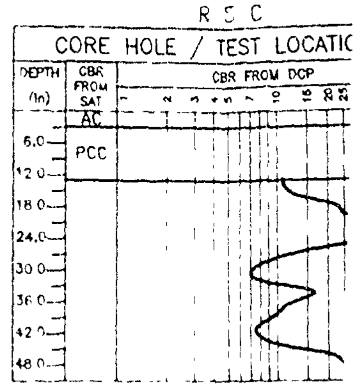

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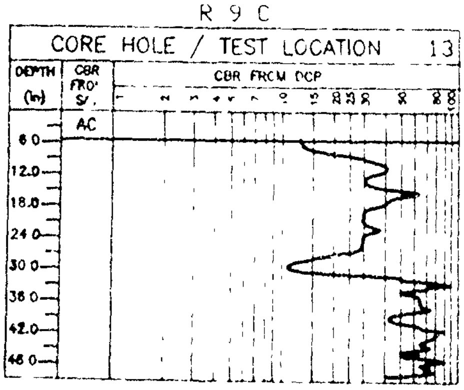

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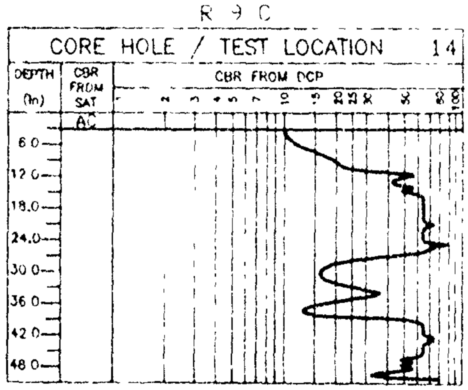

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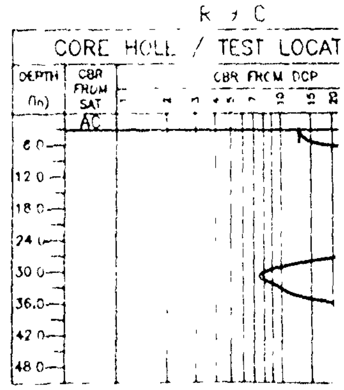

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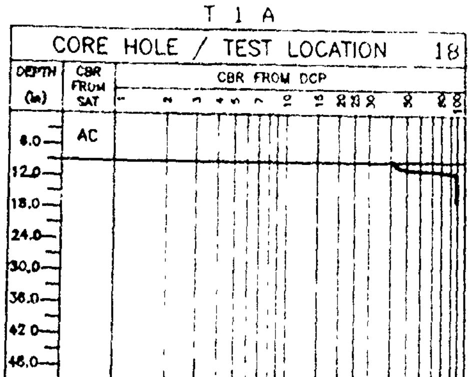
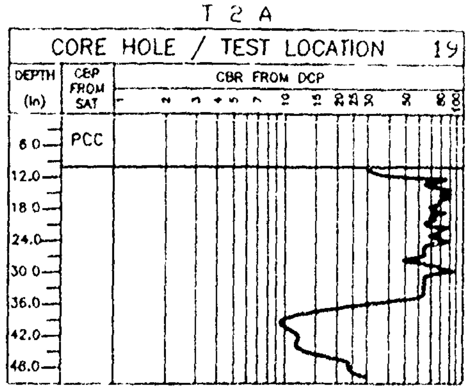


TEST TERMINATED DUE TO HARDNESS

T 2 A



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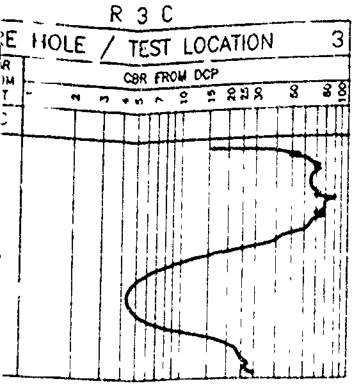

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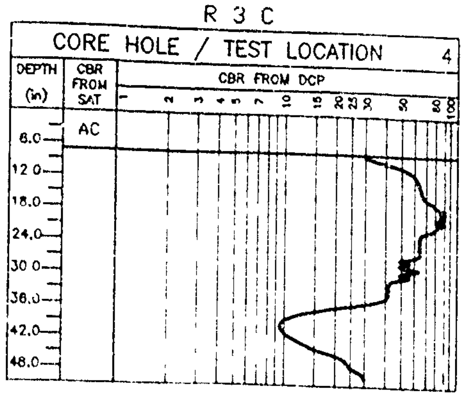
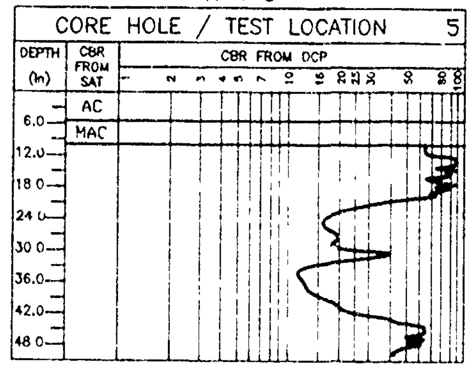


R 4 C



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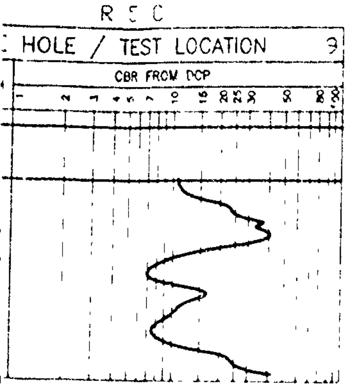
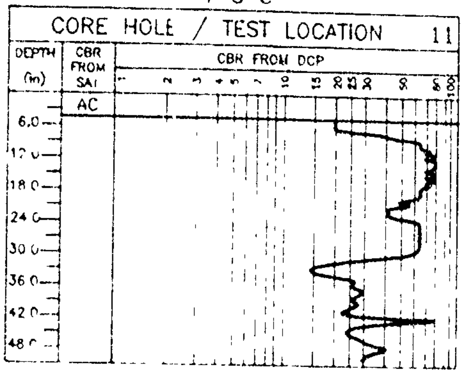


T 3 C



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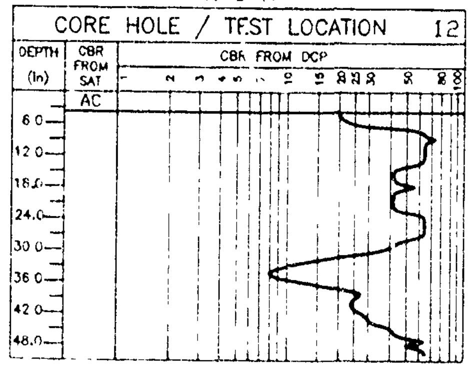

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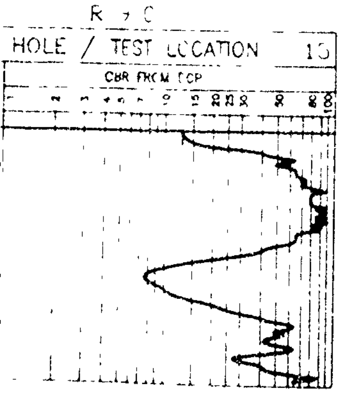

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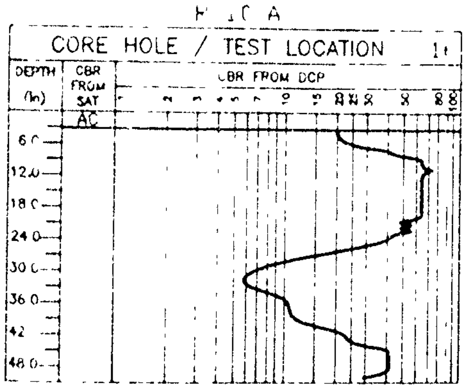

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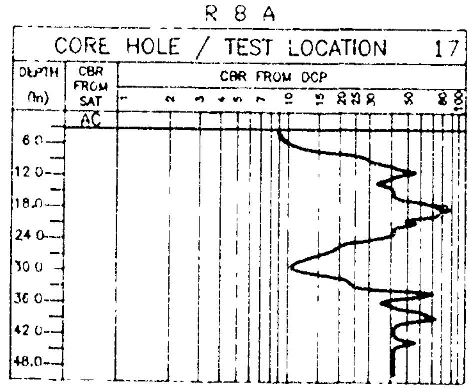

LEGEND

AC - ASPHALTIC CONCRETE
PCC - PORTLAND CEMENT CONCRETE
DCP - DYNAMIC CONE PENETROMETER
SAT - SMALL APERTURE TEST
CBR - CALIFORNIA BEARING RATIO

NOTE :

1 MAXIMUM CONE PENETRATION IS 50 INCHES BELOW PAVEMENT SURFACE

UNITED STATES AIR FORCE
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CORE HOLE / TEST LOCATION CROSS SECTIONS

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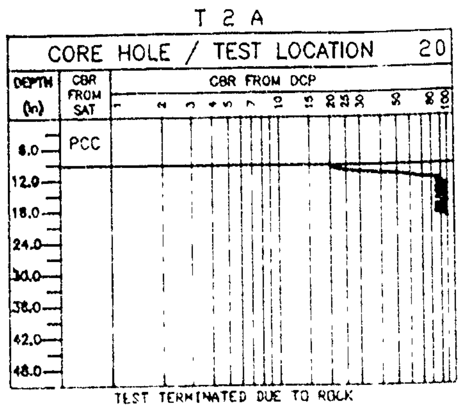
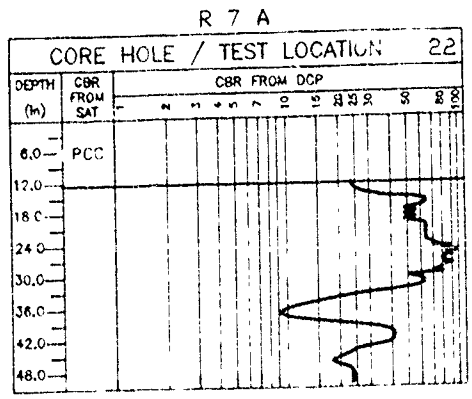
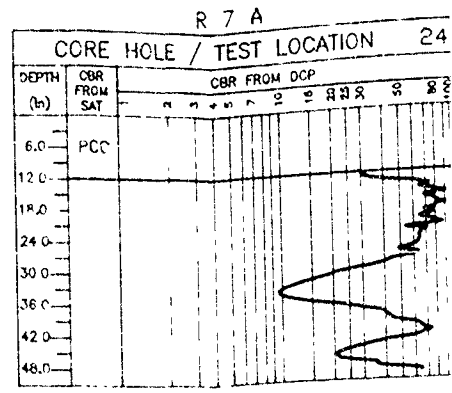
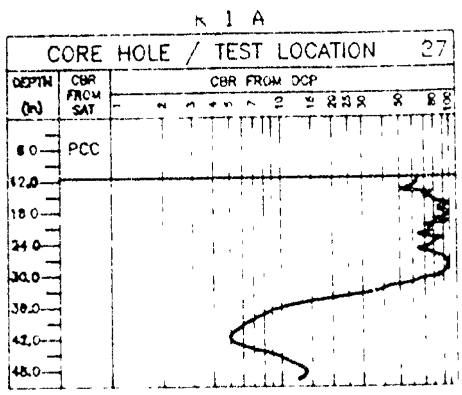
ENGINEER	DATE	DRAWING NUMBER
BUNCHER	AUGUST 1991	APPENDIX C
DRAWN MESSINA	SCALE NONE	SHEET 4 OF 5

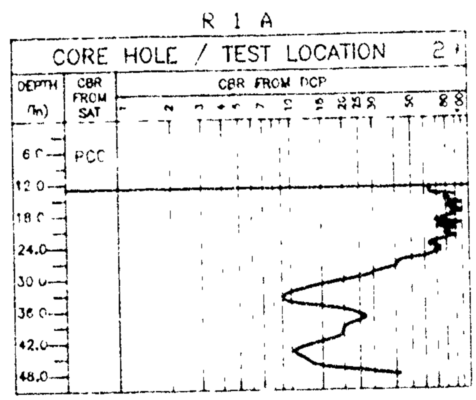


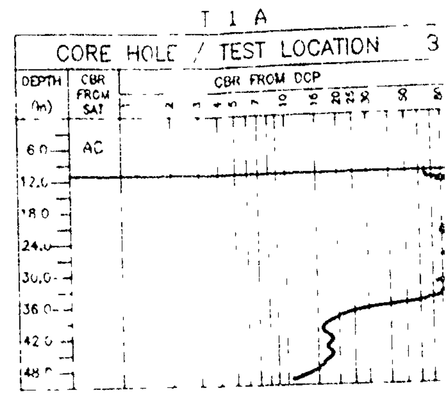
TEST TERMINATED DUE TO ROCK

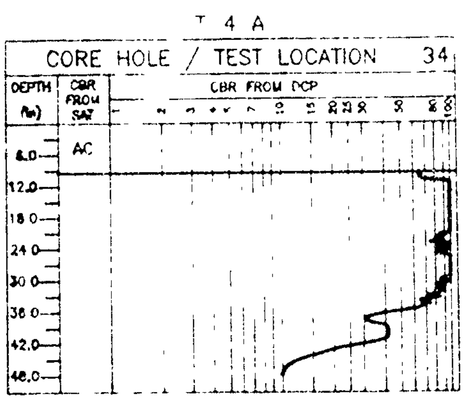


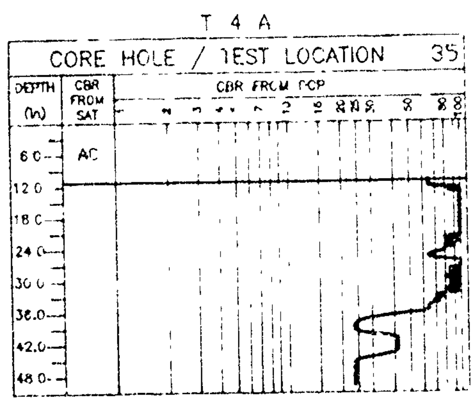


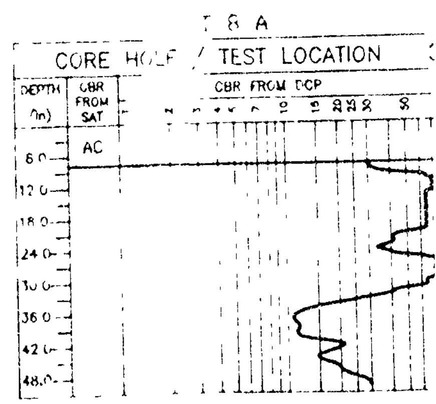


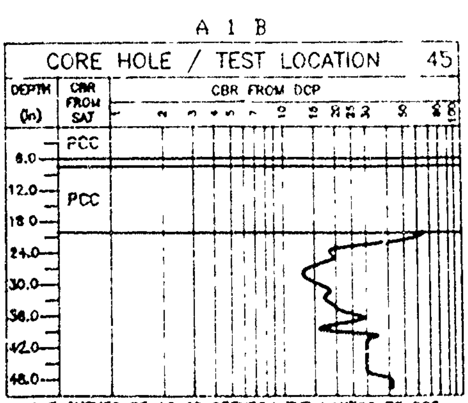




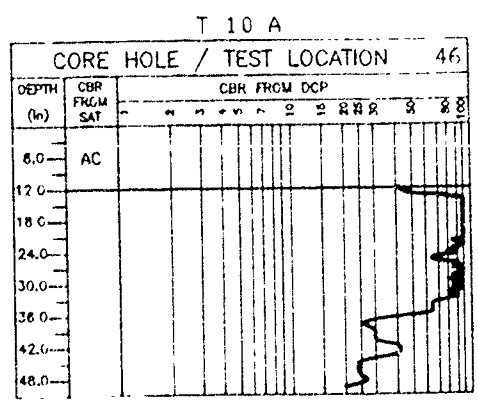




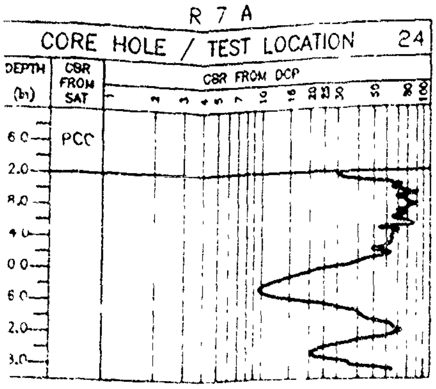




1.5 INCHES OF AC IS BETWEEN TWO LAYERS OF PCC



R 7 A



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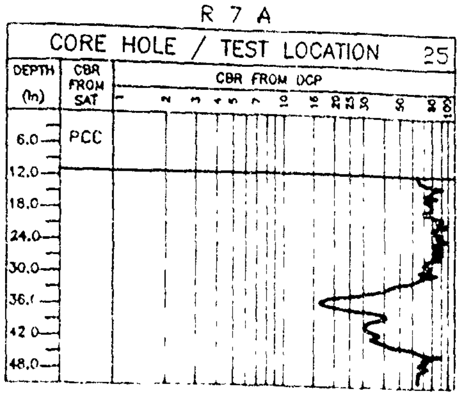
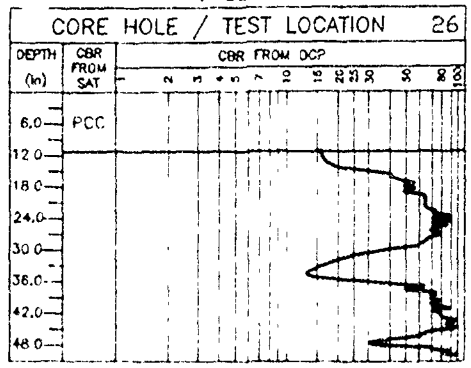
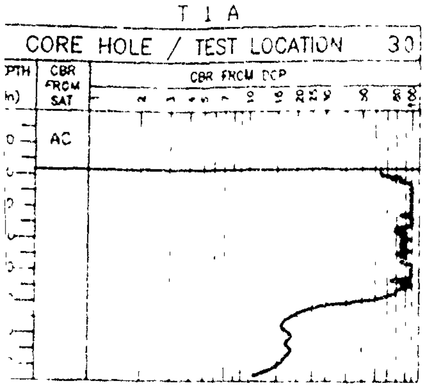


T 12 A



T 1 A



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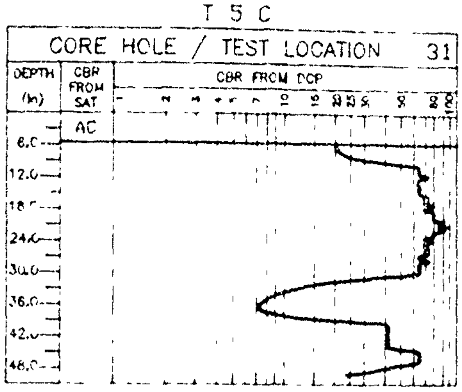

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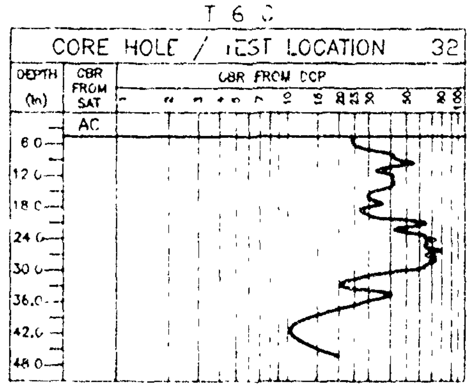

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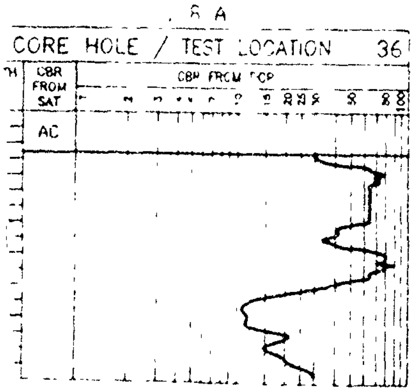
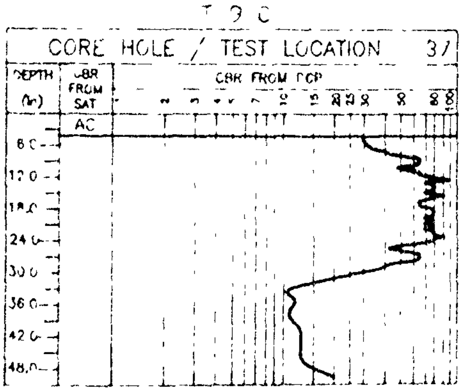
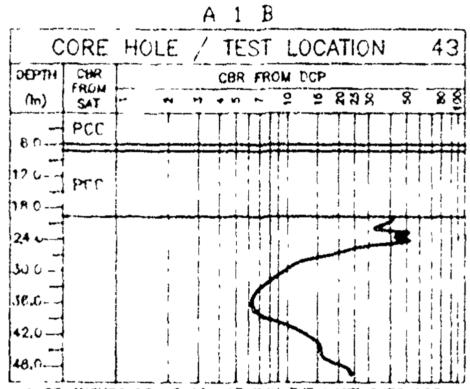


T 9 C



A 1 B



1.25 INCHES OF AC IS BETWEEN TWO LAYERS OF PCC

LEGEND

AC - ASPHALTIC CONCRETE
PCC - PORTLAND CEMENT CONCRETE
DCP - DYNAMIC CONE PENETROMETER
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NOTE

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CORE HOLE / TEST LOCATION CROSS SECTIONS

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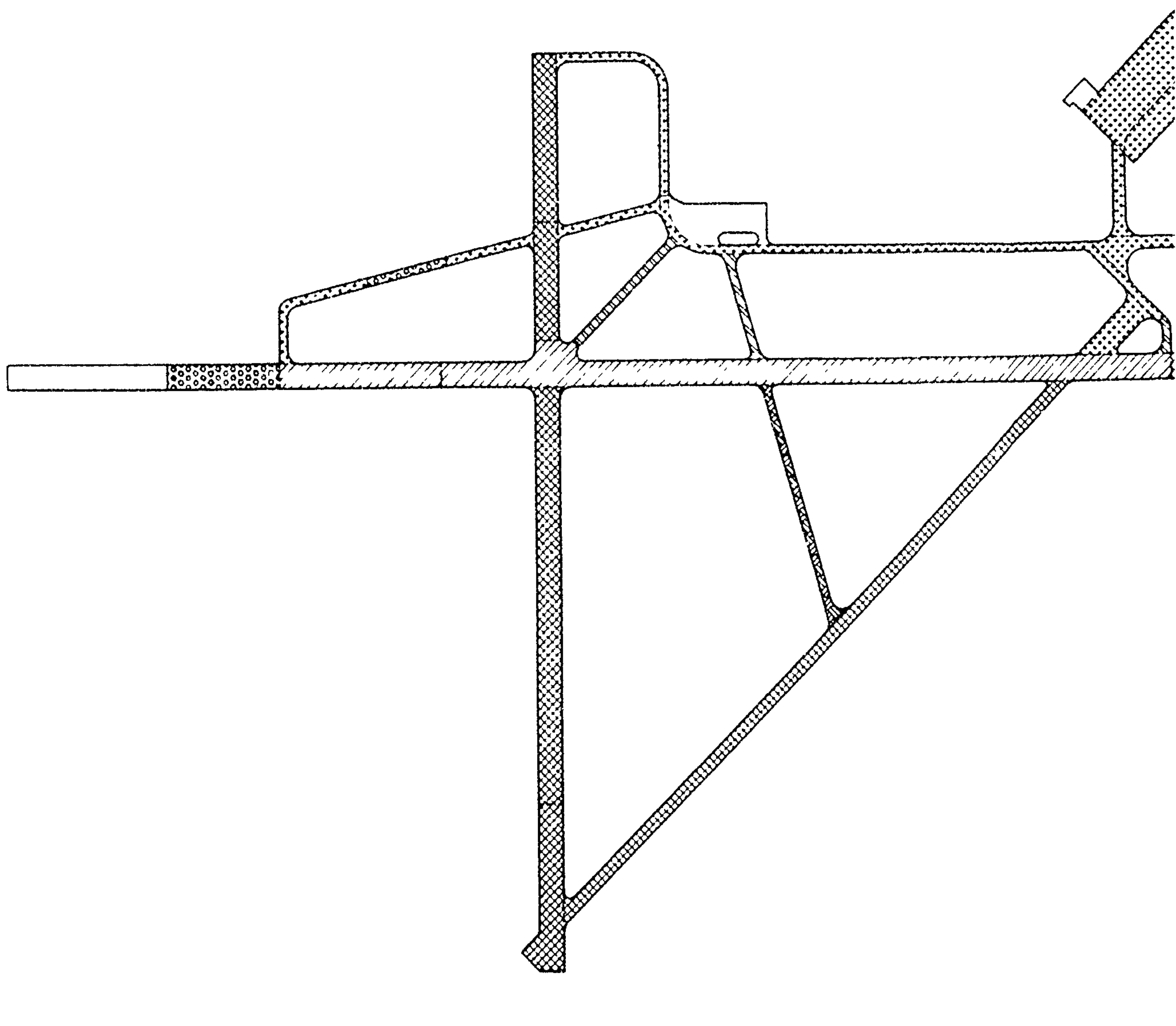
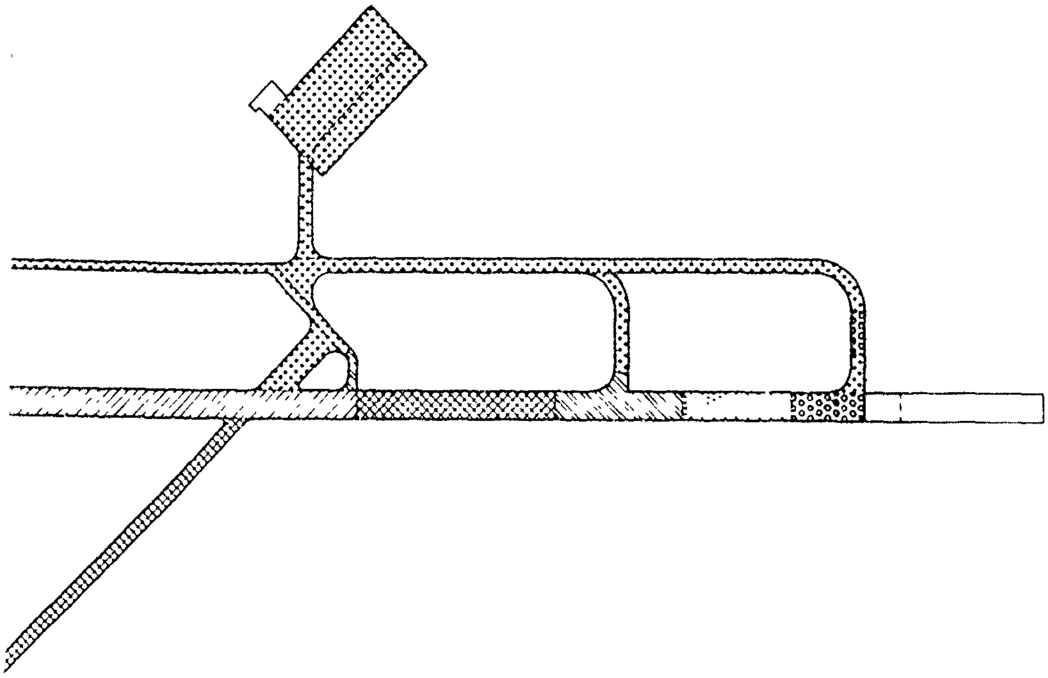
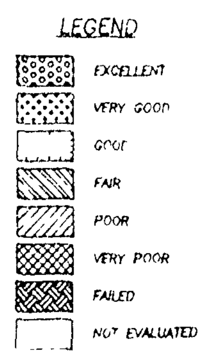
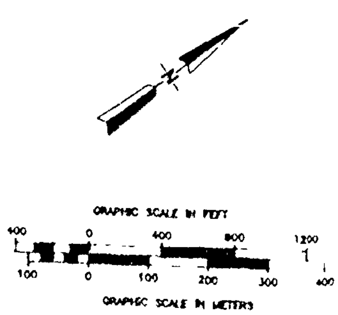
ENGINEER	DATE	DRAWING NUMBER
BUNCHER	AUGUST 1991	APPENDIX C
DRAWN: MESSINA	SCALE: NONE	SHEET 5 OF 5









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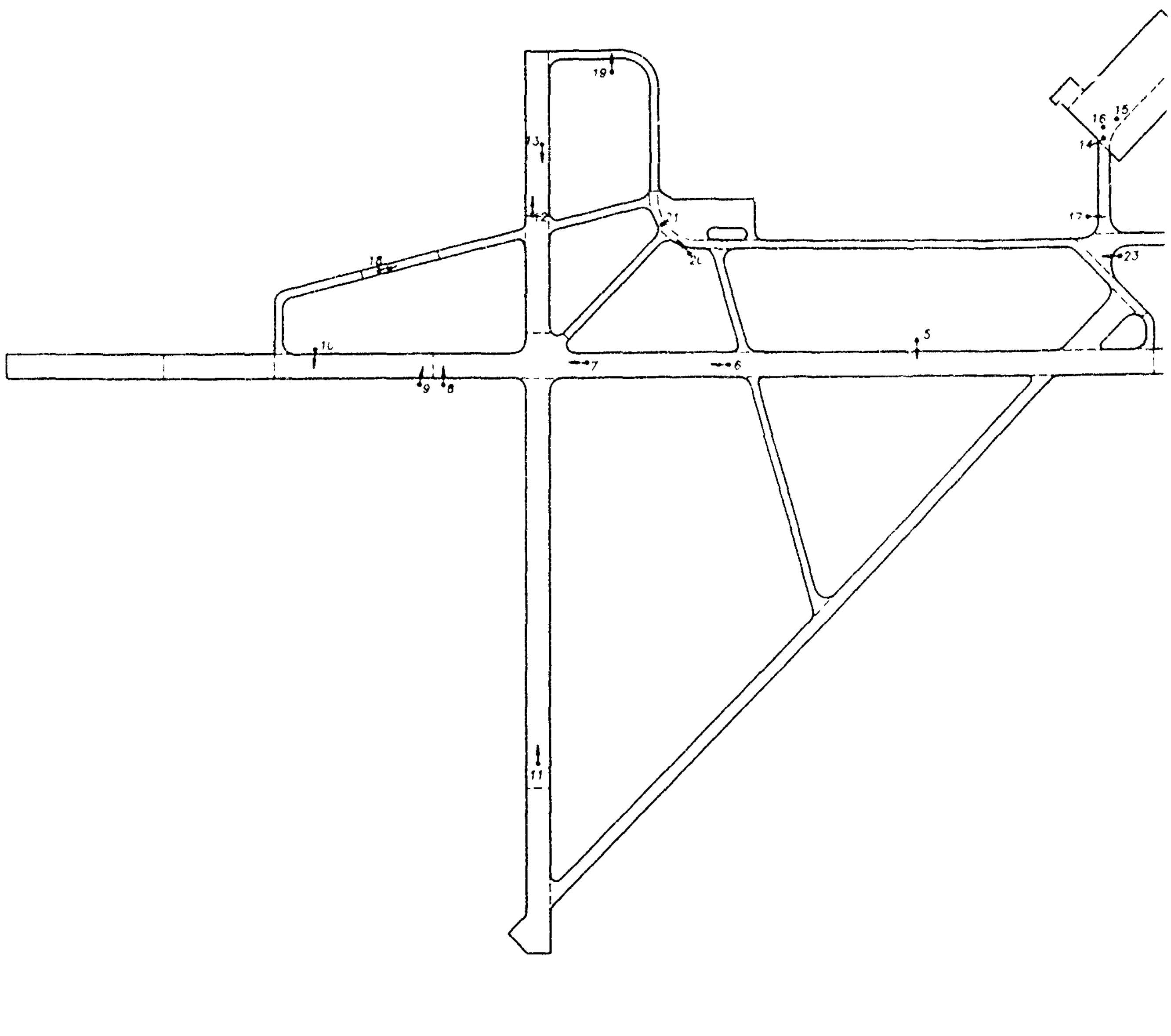
CONDITION SURVEY

SPRINGFIELD AIR NATIONAL GUARD BASE, OHIO

ENGINEER	DATE	DRAWING NUMBER
BUNCHER	AUGUST 1991	APPENDIX D
DRAWN MESSINA	SCALE GRAPHIC	SHEET 1 OF 7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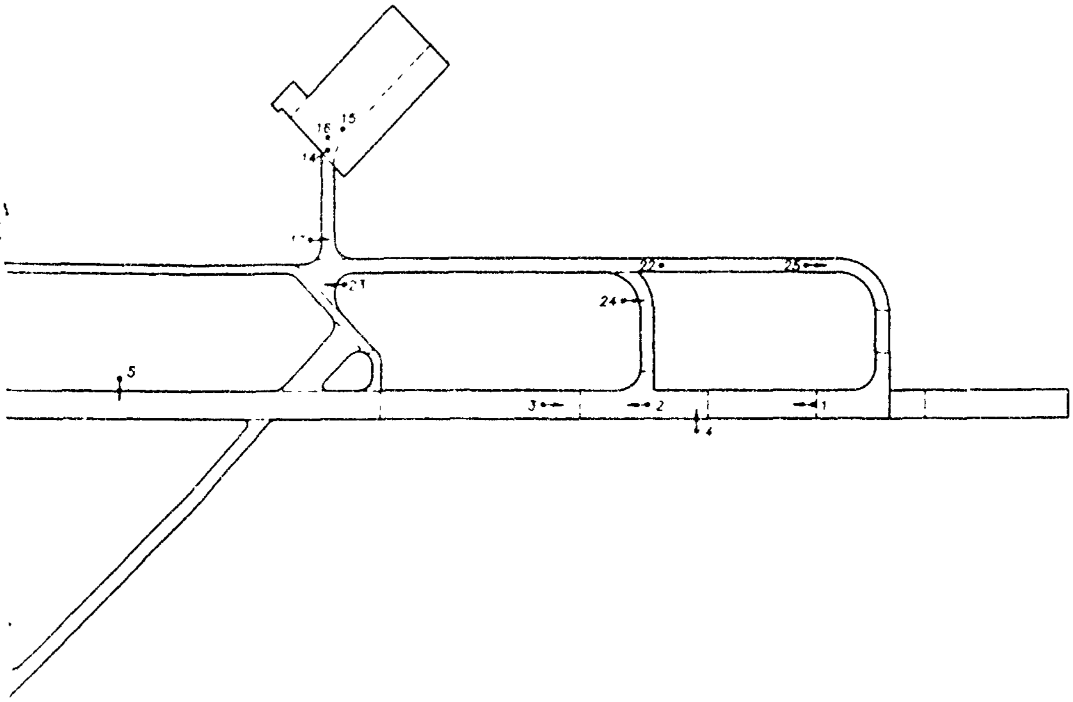
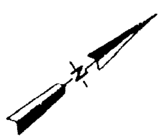
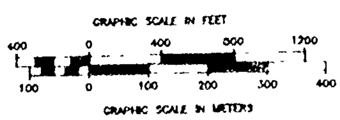


LEGEND

PHOTOGRAPH LOCATION, DIRECTION AND NUMBER





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PHOTOGRAPH LOCATIONS

SPRINGFIELD AIR NATIONAL GUARD BASE, OHIO

ENGINEER	DATE	DRAWING NUMBER
BUNCHER	AUGUST 1991	APPENDIX D
DRAWN MESSINA	SCALE GRAPHIC	SHEET 2 OF 7

PHOTO 1 : ALLIGATOR CRACKING ON CENTERLINE OF RUNWAY 06/24 (TYPICAL).

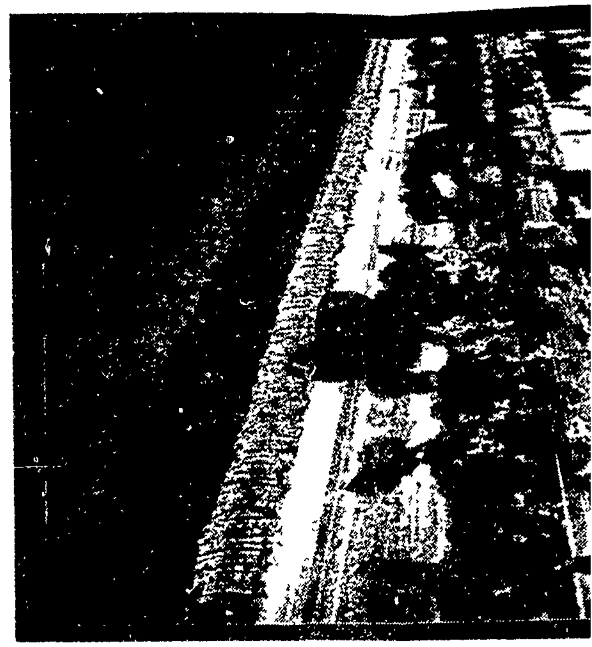


PHOTO 2 : AC SURFACE DETERIORATIION WHERE PAINT MARKINGS
RUNWAY 06/24).

PHOTO 4 : UNDERLYING PCC CRACK OF JOINT WHICH HAS DETERIORATED AND HAS CAUSED SHOVING OF AC SURFACE.

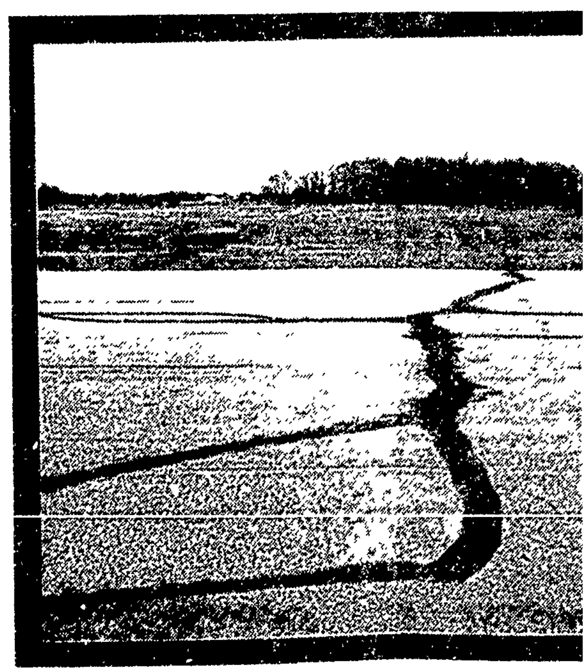
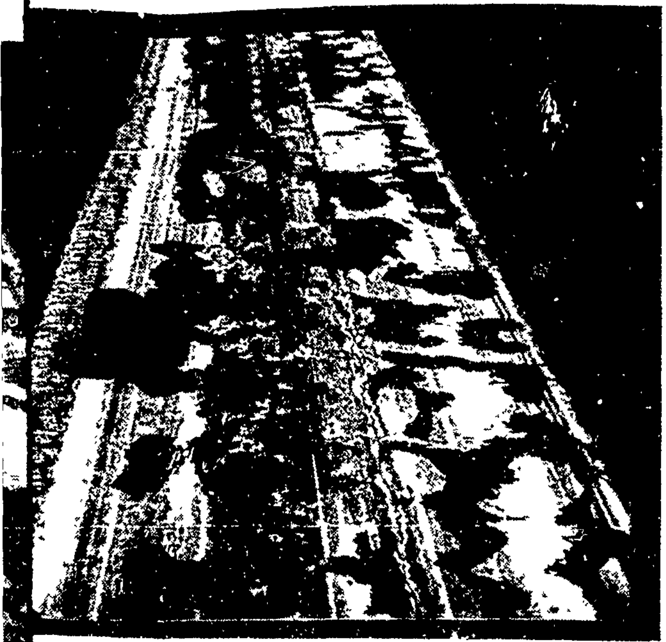


PHOTO 5 : HIGH SEVERITY TRANSVERSE SHRINKAGE CRACK EXTE
(TYPICAL ON RUNWAY 06/24). CRACKS ARE TOO W
WITHOUT A BACKER ROD.



TERIORATION WHERE PAINT MARKINGS ARE PLACED (TYPICAL ON

PHOTO 3 : MAINTENANCE CREWS HAVE POURED SEALANT ON CRUMBLING AC AREAS TO PREVENT AC FROM "BLOWING OUT" FURTHER (TYPICAL FOR FEATURE).

NSVERSE SHRINKAGE CRACK EXTENDING ACROSS RUNWAY AY 06/24). CRACKS ARE TOO WIDE TO HOLD SEALANT ROD.

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ENGINEER BUNCHER	DATE AUGUST 1991	DRAWING NUMBER APPENDIX D
DRAWN MESSINA	SCALE NONE	SHEET 3 OF

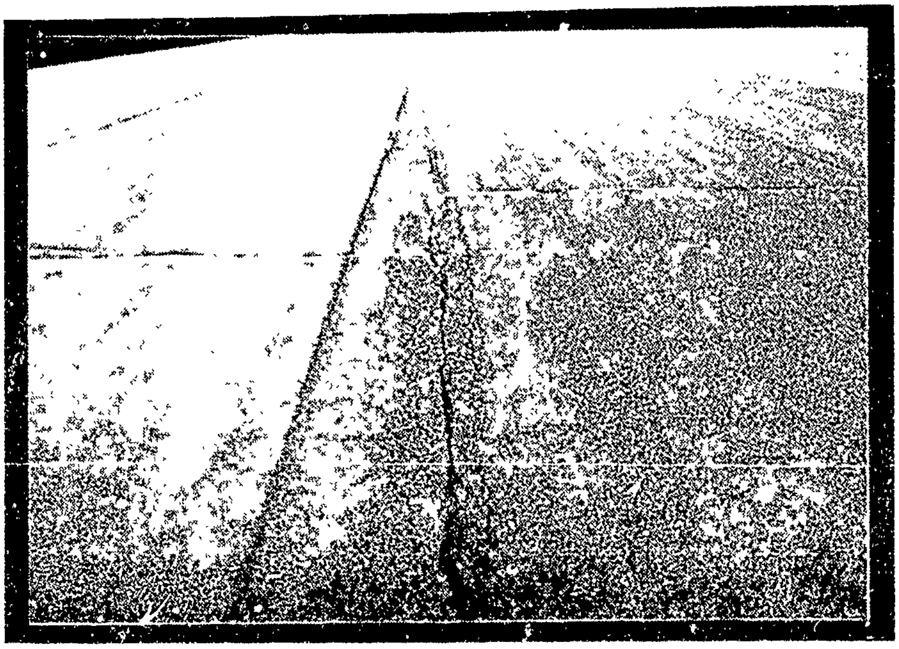


PHOTO 6 : ALLIGATOR CRACKING HAS DEVELOPED ALONG THIS SHRINKAGE CRACK WHICH IS OUTSIDE THE TRAFFIC LANE DUE TO INFILTRATING WATER WEAKENING THE BASE COURSE.

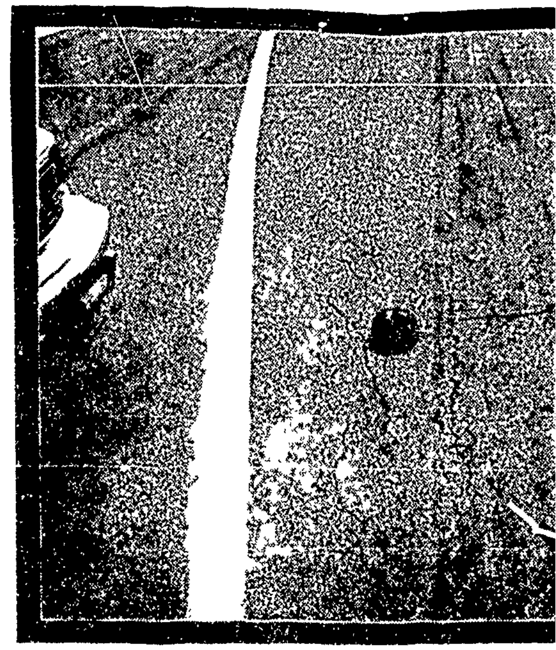
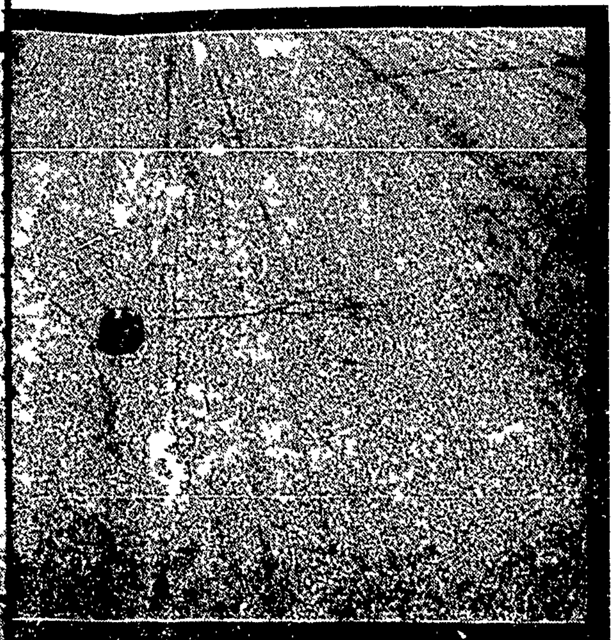


PHOTO 7 . ALLIGATOR CRACKING ALONG TRAFFIC LANES ON R

PHOTO 9 . TRANSVERSE ALLIGATOR CRACKING ON RUNWAY 06/24 (TYPICAL).

PHOTO 10 . TRANSVERSE SHRINKAGE CRACKS SUCH AS THES WIDE (TYPICAL).



G ALONG TRAFFIC LANES ON RUNWAY 06/24 (TYPICAL).

PHOTO 8 . STRUCTURAL CRACKING ON RUNWAY 06/24.

GE CRACKS SUCH AS THESE ON RUNWAY 06/24 ARE ONE INCH

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ENGINEER	DATE	DRAWING NUMBER
BUNCHER	AUGUST 1991	APPENDIX D
DRAWN MESSINA	SCALE NONE	SHEET 4 OF 7

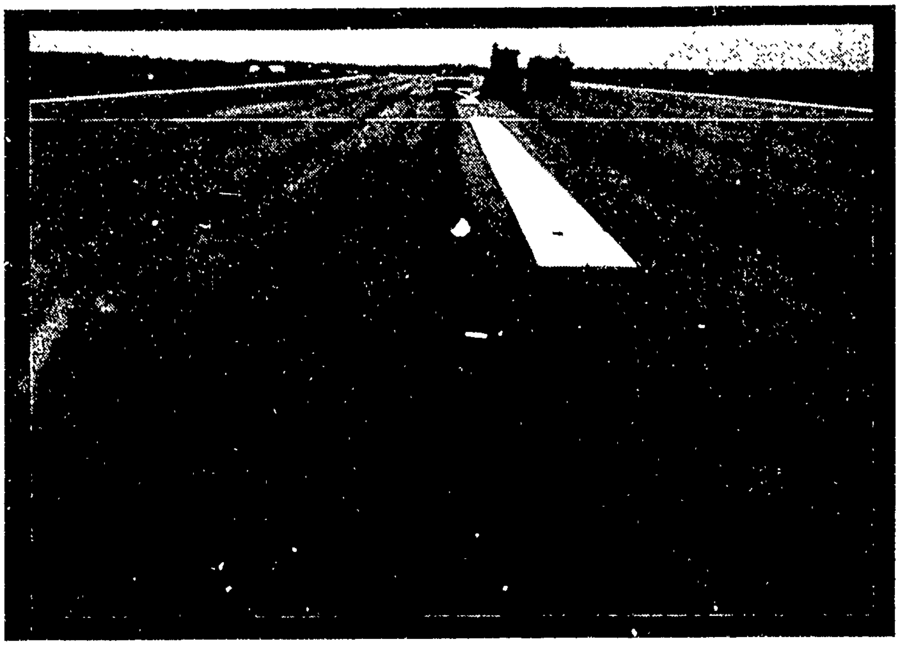


PHOTO 11: BOTH BLOCK AND ALLIGATOR CRACKING ARE EVIDENT THROUGHOUT RUNWAY 15/33. ALLIGATOR CRACKING IS MORE PREVALENT IN THE TRAFFIC LANES.

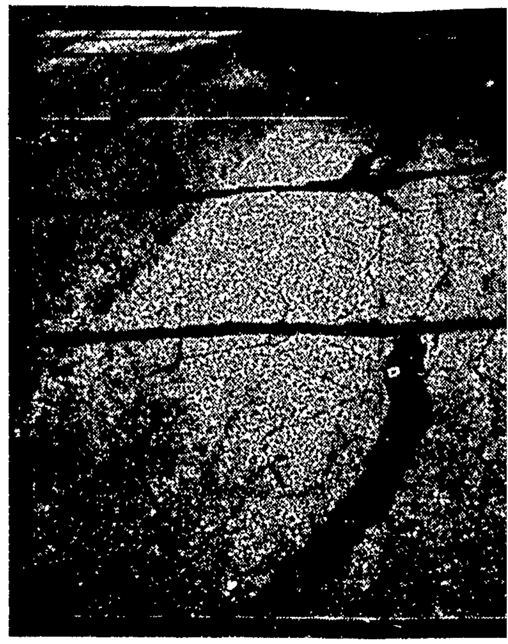
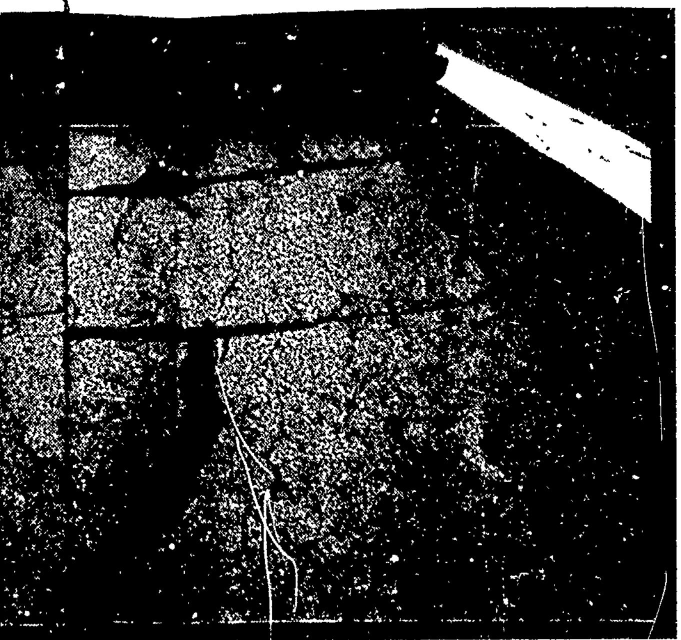


PHOTO 12: ALLIGATOR CRACKING ON THE NORTHWEST EN ONCE PARKED.

PHOTO 14: STRUCTURAL CRACKS LOCATED AT THE THROAT OF THE PCC ANG APRON WHERE ALL MILITARY TRAFFIC OCCURS.

PHOTO 15: LOW SEVERITY CORNER BREAK ON APRON WH



WAY 15, NG ON THE NORTHWEST END OF RUNWAY 15/33 WHERE A C-5 WAS

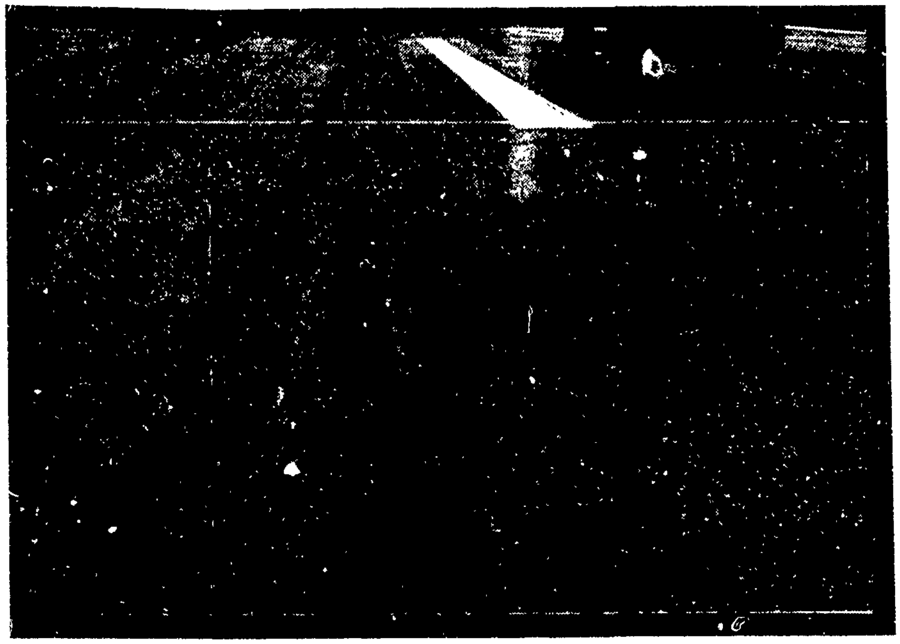
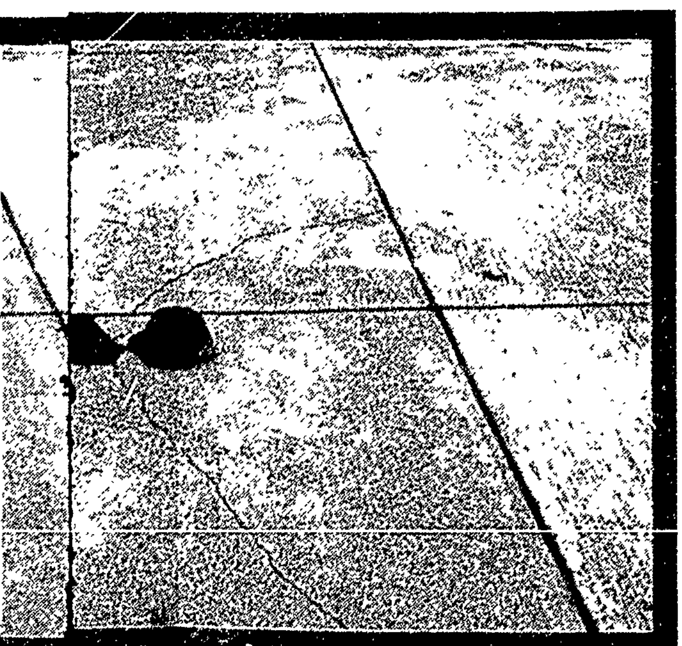


PHOTO 13. ALLIGATOR CRACKING ON THE NORTHWEST END OF RUNWAY 15/33 WHERE A C-5 WAS ONCE PARKED.



RES RO NER BREAK ON APRON WHICH REQUIRES ROUTING AND SEALING.

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PHOTOGRAPHS		
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ENGINEER BUNCHER	DATE AUGUST 1991	DRAWING NUMBER APPENDIX
DRAWN MESSINA	SCALE NONE	SHEET 5

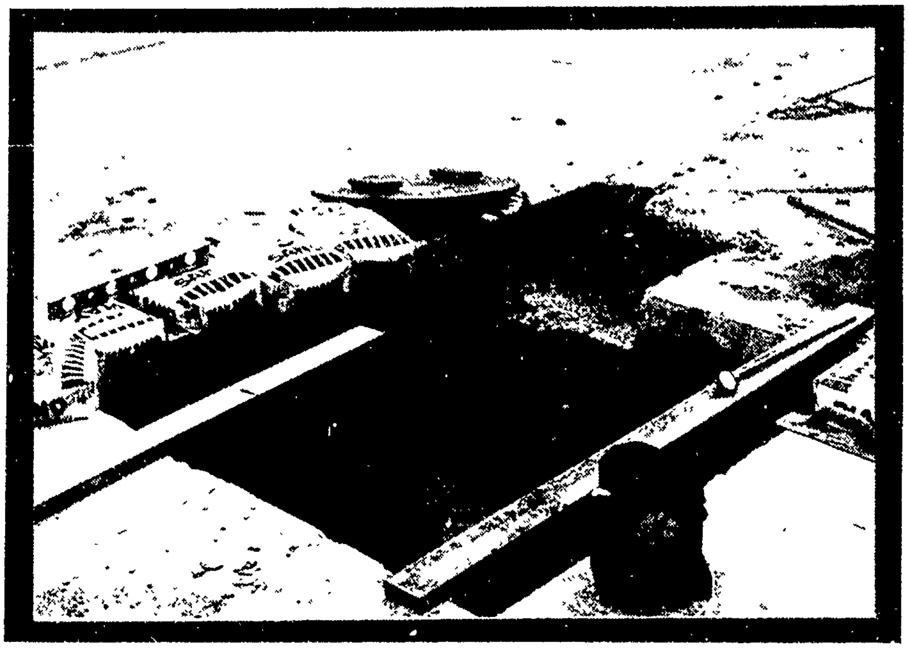

PHOTO 16 : TEST PIT #1 SHOWING THE 6 INCH PCC UNBONDED OVERLAY OVER ORIGINAL 12 INCH PCC.

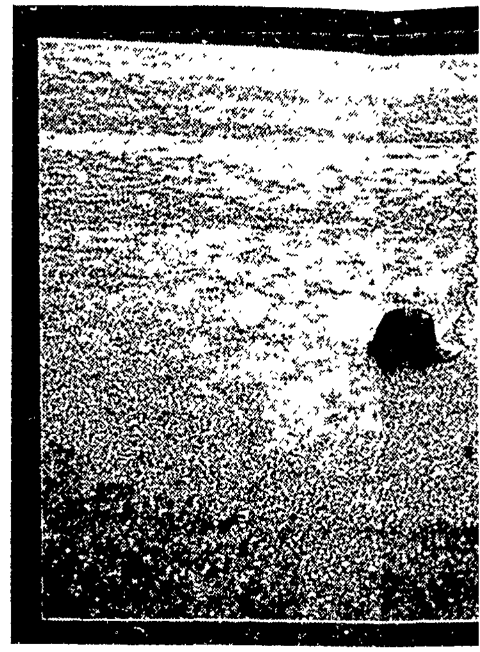

PHOTO 17 : SHRINKAGE CRACK ON APRON TAXIWAY WI

PHOTO 19 : EVENLY SPACED SHRINKAGE CRACKS SUCH AS THESE ON TAXIWAY F ARE UP TO HALF AN INCH WIDE AND SHOULD BE ROUTED AND SEALED ASAP (TYPICAL).

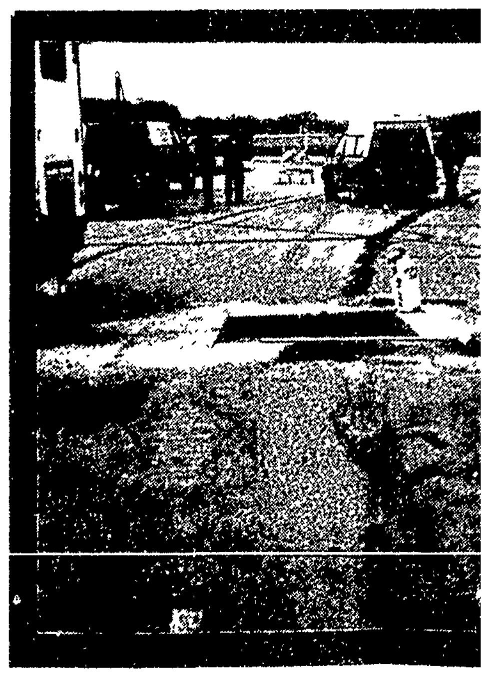

PHOTO 20 : TEST PIT #7 WHERE PCC WAS FOUND UN LONGITUDINAL CRACK IS THE TRANSITION

N TAXIWAY WHICH SHOULD BE SEALED (TYPICAL).

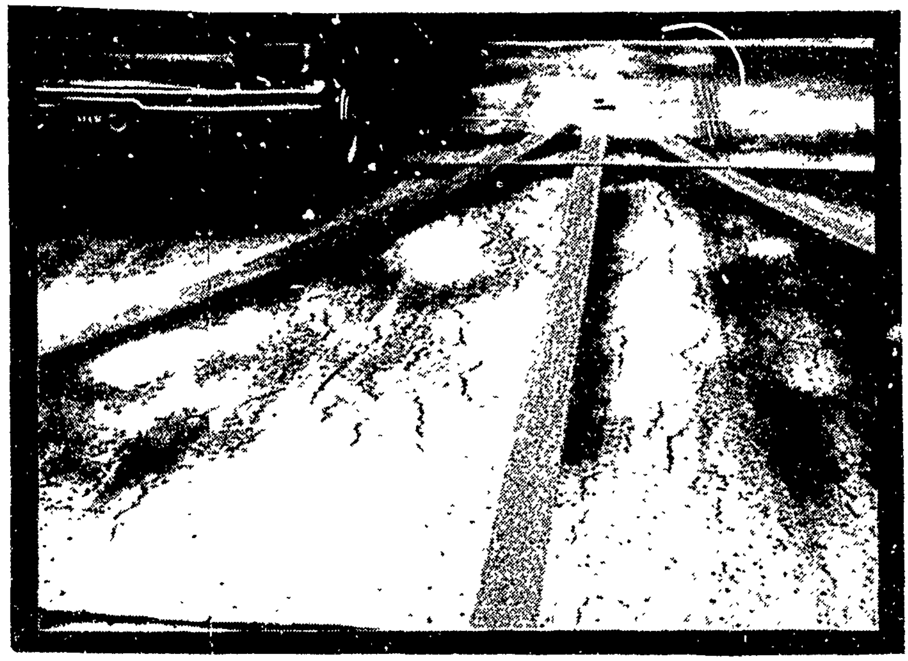

PHOTO 18. SHRINKAGE CRACKS ON ARM/DEARM PAD WHICH ONLY ARE VISIBLE WHEN PCC IS DAMP.

S FOUND UNDER AC IN RIGHT HALF OF TEST PIT THE
TRANSITION WHERE A FLEXIBLE TAXIWAY WAS ADDED.

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ENGINEER	DATE	DRAWING NUMBER
BUNCHER	AUGUST 1991	APPENDIX D
DRAWN: MESSINA	SCALE: NONE	SHEET 6 OF 7

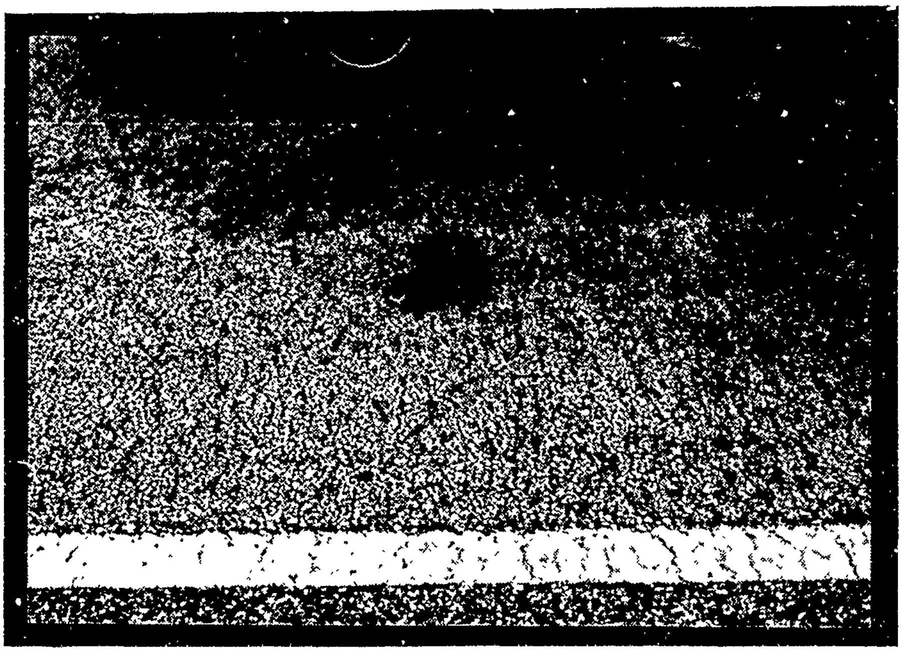


PHOTO 21: FINE TRANSVERSE CRACKS CAUSED FROM AC MIX BEING LAID TOO HOT DURING OVERLAY OF TAXIWAY A. THESE SHOW UP BEST WHEN PAVEMENT IS DAMP.

PHOTO 22, FINE TRANSVERSE CRACKS CAUSED FROM AC MIX BE OF TAXIWAY A. THESE SHOW UP BEST WHEN PAVEME

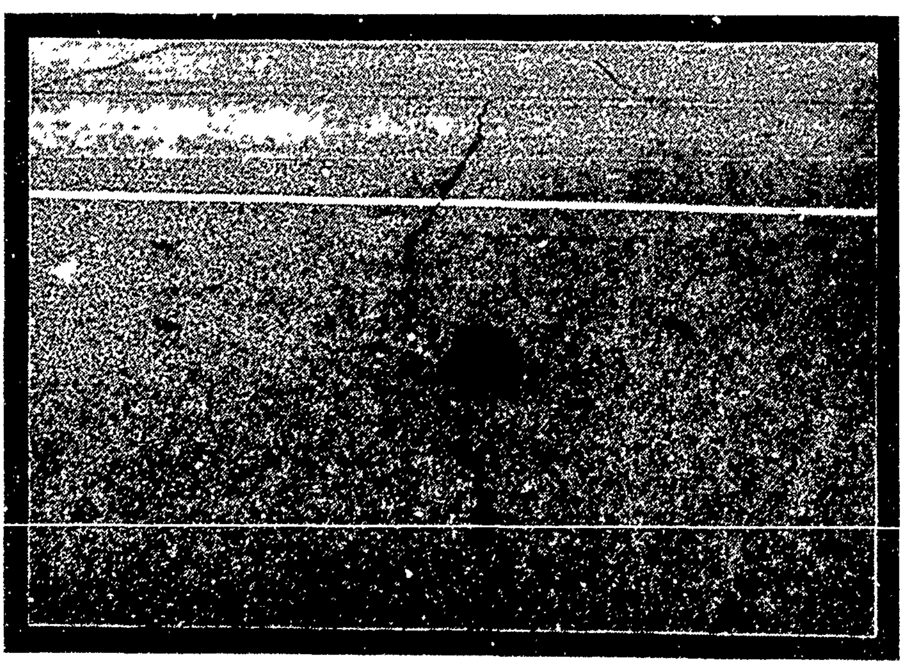


PHOTO 24. LOW SEVERITY SHRINKAGE CRACK REQUIRES SEALING ON TAXIWAY B (TYPICAL).

PHOTO 25: LOW SEVERITY PAVING LANE CRACKS ON TAXIWAY A WORSE SINCE THEY WERE SEALED EARLY.

FROM AC MIX BEING LAID TOO HOT DURING OVERLAY
EST WHEN PAVEMENT IS DAMP.

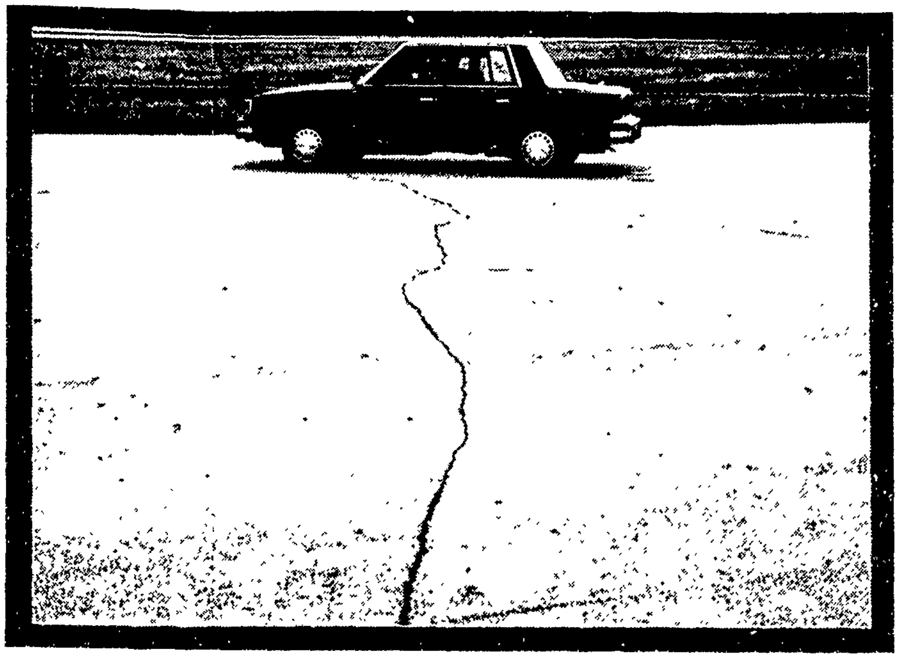
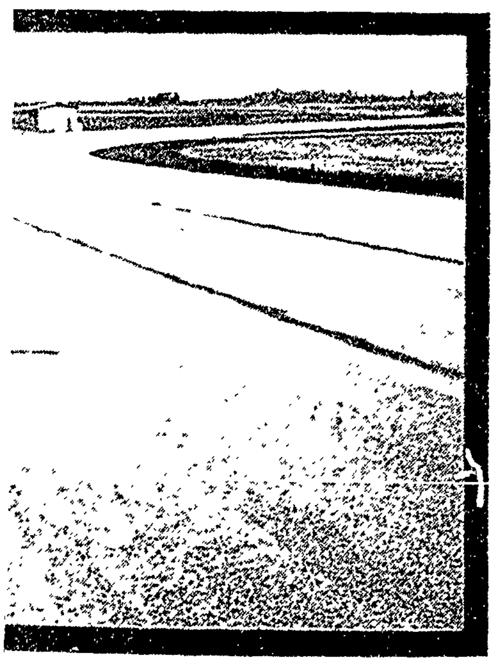


PHOTO 23. AC SHRINKAGE CRACK ON TAXIWAY C WHICH REQUIRES ROUTING AND SEALING ASAP (TYPICAL)



KS ON TAXIWAY A (TYPICAL) WHICH ARE NOT GETTING
EARLY.

UNITED STATES AIR FORCE CIVIL ENGINEERING SUPPORT AGENCY TYNDALL AIR FORCE BASE, FLORIDA		
PHOTOGRAPHS		
SPRINGFIELD AIR NATIONAL GUARD BASE, OHIO		
ENGINEER BUNCHER	DATE AUGUST 1991	DRAWING NUMBER APPENDIX D
DRAWN MESSINA	SCALE NONE	SHEET 7 OF 7

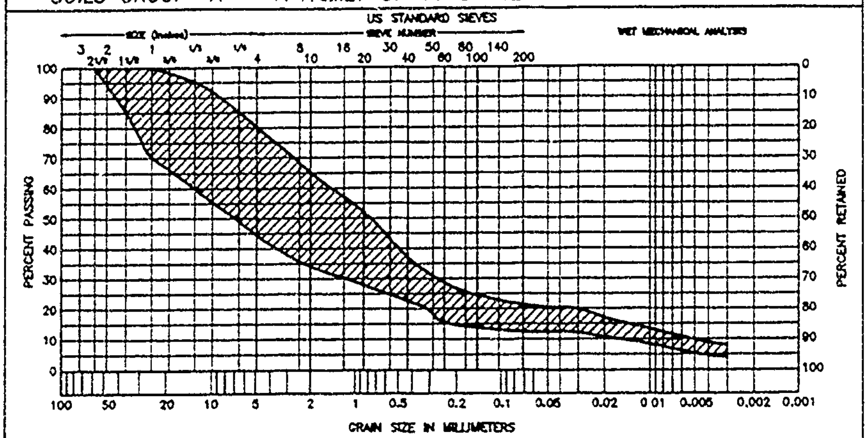
SUMMARY OF PHYSICAL PROPERTY DATA

FACILITY					OVERLAY PAVEMENT			PAVEMENT			BASE			SUBBASE			SUBGRADE	
FEAT	IDENT	LGTH (ft)	WDTH (ft)	GEN COND	THICK (in)	DESCRP	1000E / FLEX	THICK (in)	DESCRP	1000E / FLEX	THICK (in)	DESCRP	1000E / K/CBR	THICK (in)	DESCRP	1000E / CBR	DESCRP	1000E / K/CBR
R01A	RUNWAY 06	700	150	EXCEL			/	12.0	PCC	770 /	15	GM	/ 250			/	CLAY (CL)	/ 6
R02C	RUNWAY 06	1000	150	POOR	3.0	AC	/	2.5	AC	/	9.0	SILTY SAND SM	/ 30	12.0	SANDY SILT SP-SM	/ 9	CLAY CL	/ 4
R03C	RUNWAY 06-24 15-33 INTERSEC	3000	150	POOR	3.5	AC	/	2.5	AC	/	9.0	SILTY SAND SM	/ 30	12.0	SANDY GRAVEL SP-SM	/ 9	CLAY CL	/ 6
R04C	RUNWAY 24	1100	150	VERY POOR	2	AC	/	3	AC	/	12	SM	/ 30	6	DRY BND. MACADAM NOT TESTED	/	CLAY CL	/ 6
R05C	RUNWAY 24	700	150	FAIR	3.5	AC	/	10.0	PCC	500 /	12	SILTY GRAVEL	/ 250			/	CLAY CL	/ 6
R06A	RUNWAY 24	600	150	GOOD	3.0	AC	/	3.0	AC	/	11-15"	SP-SM	/ 30	8	SM	/ 9	CLAY CL	/ 6
R07A	RUNWAY 24	400	150	EXCEL			/	12	PCC	770 / 250	15	GM	/			/	CLAY CL	/ 6
R08A	RUNWAY 15	1000	150	VERY POOR			/	3.5	AC	/	9	SM SILTY SAND	/ 20	12	SM SILTY SAND	/ 35	CLAY CL	/ 5
R09C	RUNWAY 15-33	3550	150	VERY POOR			/	3	AC	/	9	SM SILTY SAND	/ 20	12	SM SILTY SAND	/ 35	CLAY CL	/ 5
R10A	RUNWAY 33	1000	150	VERY POOR			/	3.5	AC	/	9	SM SILTY SAND	/ 20	12	SM SILTY SAND	/ 40	CLAY CL	/ 4
T01A	RNWY-06 ACCESS	2150	75	VERY GOOD	7	AC	/	3	AC	/	23	BASE	/ 80			/	CL	/ 4
T02A	SW ARM/ DEARM AREA	400	75	EXCEL			/	9	PCC	775 /			/			/	CLAY CL	/ 250
T03C	RNWY-15 ACCESS	1500	75	VERY GOOD	2	AC	/	3	AC	/	15		/ 35	10		/ 30	CLAY CL	/ 5

FACILITY					OVERLAY PAVEMENT			PAVEMENT			BASE			SUBBASE			SUBGRADE	
FEAT	IDENT	LGTH (ft)	WDTH (ft)	GEN COND	THICK (in)	DESCRP	1000E FLEX	THICK (in)	DESCRP	1000E FLEX	THICK (in)	DESCRP	1000E K/CBR	THICK (in)	DESCRP	1000E CBR	DESCRP	1000E K/CBR
T04A	PARALLEL TXWY	3975	75	VERY GOOD	6	AC	—	3	AC	—	20	SM	—/80	12	SM	—/30	CLAY CL	—/5
T05C	APRON ACCESS	900	75	FAIR	2	AC	—	3	AC	—	25	SM	—/40			—	CLAY	—/5
T06C	APRON ACCESS	850	75	FAIR	1	AC	—	3	AC	—	12	SM	—/30	12	SM	—/50	CLAY CL	—/5
T07A	GUARD APRON ACCESS	500	75	VERY GOOD	3	AC	—	3	AC	—	20	SM	—/80	12		—/30	CLAY CL	—/5
T08A	PARALLEL TAXIWAY ACCESS	225	150	VERY GOOD	5	AC	—	3	AC	—	15	SM	—/25	9	SM	—/15	CLAY CL	—/5
T09C	PARALLEL ACCESS TAXIWAY	200	75	FAIR	1	AC	—	3	AC	—	14	SM	—/30	8	SM	—/9	CLAY CL	—/6
T10A	RNWY-24 ACCESS	3400	75	VERY GOOD	8	AC	—	3	AC	—	20	SP-SM	—/80	12	SM	—/30	CLAY CL	—/5
T11C	RNWY-24 ACCESS	550	75	VERY GOOD	3	AC	—	3	AC	—	14	SM	—/30	8	SM	—/9	CLAY CL	—/6
T12A	NE ARM/ DEARM AREA	400	75	EXCEL			—	12	PCC	800/210			—			—	CLAY CL	—
A01B	GUARD APRON	800	330	VERY GOOD	6	PCC WITH 1" BOND BREAKER	—	12.5	PCC	760/—			—			—	CLAY CL	—/120
A02B	GUARD APRON	830	155	VERY GOOD	6	PCC WITH 1" BOND BREAKER	—	10	PCC	650/—			—			—	CLAY CL	—/120

GRAIN SIZE DISTRIBUTION GRAPH – AGGREGRATE GRADING CHART

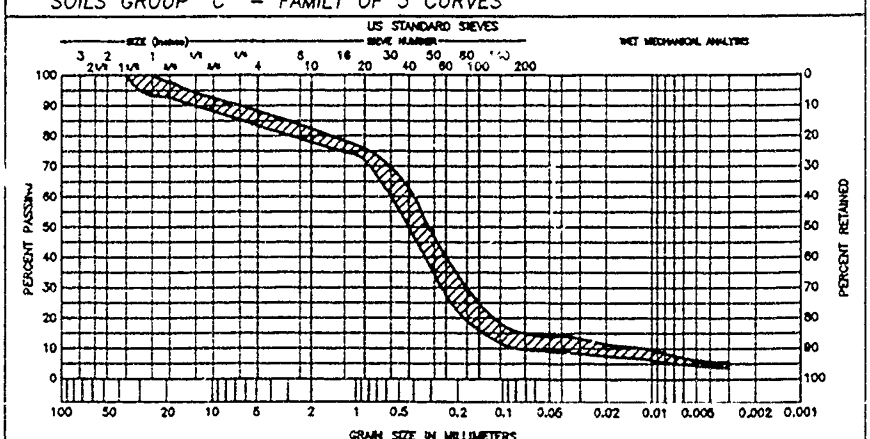
BASE SOILS GROUP "A" – A FAMILY OF 10 CURVES



TEST PIT	LAYER	DEPTH	Gs	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	FROST GROUP	U.S.C.S. CLASS.	MUNSELL COLOR DESIGNATION
2	BC	12.5	2.759	NP	NP	NP	F2	SM	10 YR 7/4 VERY PALE BROWN
3	BC	5	2.726	NP	NP	NP	F2	SM	10 YR 6/4 LT YELLOW BROWN
4	BC	6.5	2.726	NP	NP	NP	F2	SM	10 YR 6/4 LT YELLOW BROWN
4	SB	15	2.736	NP	NP	NP	F2	SM	10 YR 7/4 VERY PALE BROWN
5	BC	3.5	2.732	NP	NP	NP	F2	SM	10 YR 6/4 LT YELLOW BROWN
5	SB	12	2.704	NP	NP	NP	F3	SM	10 YR 6/4 LT YELLOW BROWN
5	SB	14	2.721	NP	NP	NP	F2	SM	10 YR 6/4 LT YELLOW BROWN
6	BC	4	2.714	NP	NP	NP	F2	SM	10 YR 6/4 LT YELLOW BROWN
6	SB	12.5	2.720	NP	NP	NP	F2	SM	10 YR 6/4 LT YELLOW BROWN
7	BC	8.5	2.711	NP	NP	NP	F2	SM	10 YR 6/4 LT YELLOW BROWN

GRAIN SIZE DISTRIBUTION GRAPH – AGGREGRATE GRADING CHART

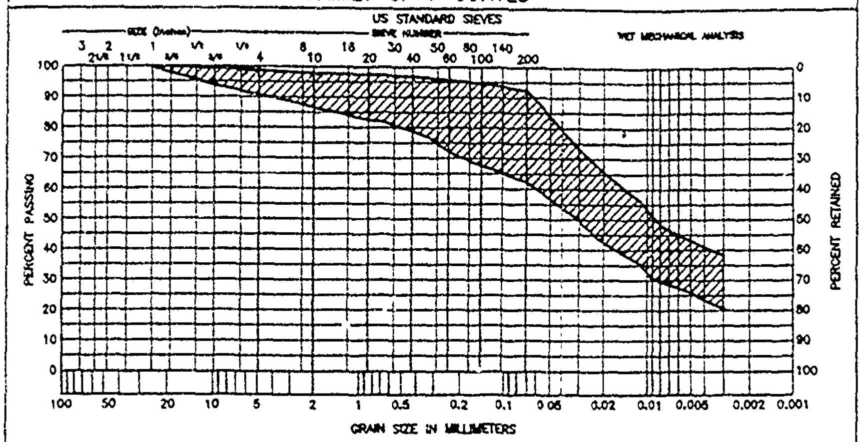
BASE SOILS GROUP "C" – FAMILY OF 3 CURVES



TEST PIT	LAYER	DEPTH	Gs	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	FROST GROUP	U.S.C.S. CLASS.	MUNSELL COLOR DESIGNATION
3	SB	19	2.733	NP	NP	NP	F2	SW–SM	10 YR 6/4 LT YELLOW BROWN
4	SB	21	2.715	NP	NP	NP	F2	SP–SM	10 YR 6/4 LT YELLOW BROWN
6	SB	22	2.730	NP	NP	NP	F2	SM	10 YR 6/4 LT YELLOW BROWN

GRAIN SIZE DISTRIBUTION GRAPH – AGGREGRATE GRADING CHART

BASE SOILS GROUP "B" – A FAMILY OF 7 CURVES



TEST PIT	LAYER	DEPTH	Gs	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	FROST GROUP	U.S.C.S. CLASS.	MUNSELL COLOR DESIGNATION
1	SG	19	2.712	21.1	14.9	6 2	F4	CL–CM	10 YR 7/4 VERY PALE BROWN
2	SG	24	2.700	34.2	17.5	15.7	F3	CL	10 YR 5/3 BROWN
2	SG	55	2.664	41.4	20.6	20.8	F3	CL	10 YR 6/4 LT YELLOW BROWN
3	SG	27	2.759	46.3	20.5	25.8	F3	CL	10 YR 5/4 YELLOW BROWN
4	SG	27	2.756	28.2	17.6	10.6	F4	CL	10 YR 6/4 LT YELLOW BRON
5	SG	25	2.774	32.7	17.51	15.2	F3	CL	10 YR 6/4 LT YELLOW BRON
6	SG	26	2.740	40.4	20.0	20.4	F3	CL	2.5 YR 6/4 LT REDDISH BROWN

LEGEND

- NP — NON PLASTIC
- NFS — NOT FROST SUPCEPTABLE
- F1, F2, F3, F4 — SOIL FROST GROUPS WITH F4 BEING MOST FROST SUPCEPTABLE
- BC — BASE COURSE
- SB — SUBBASE
- SG — SUBGRADE

UNIFIED SOIL CLASSIFICATION

- SP — POORLY GRADED SAND
- SW–SM — WELL-GRADED SILTY SAND
- SP–SM — POORLY GRADED SILTY SAND
- SM — SILTY SAND
- CL — LEAN CLAY (LOW TO MEDIUM PLASTICITY)
- CL–ML — SILTY CLAY (LOW TO MEDIUM PLASTICITY)

UNITED STATES AIR FORCE
CIVIL ENGINEERING SUPPORT AGENCY
TYNDALL AIR FORCE BASE, FLORIDA

LABORATORY TEST RESULTS

SPRINGFIELD AIR NATIONAL GUARD BASE, OHIO

ENGINEER	DATE	DRAWING NUMBER
BUNCHER	AUGUST 1991	APPENDIX E
DRAWN: MESSINA	SCALE: NONE	SHEET 3 OF 3

SUMMARY OF ALLOWABLE GROSS LOADS IN BRITISH UNITS

FEAT.	PASS INTENSITY LEVEL	PAVEMENT CAPACITY IN KIPS FOR AIRCRAFT GROUP INDEX NUMBERS												
		1	2	3	4	5	6	7	8	9	10	11	12	13
R01A	I	+	+	95	+	+	+	176	+	369	+	+	+	353
	II	+	+	+	+	+	+	205	+	414	+	+	+	425
	III	+	+	+	+	+	+	+	+	+	+	+	+	+
	IV	+	+	+	+	+	+	+	+	+	+	+	+	+
	V	+	74	78	+	+	131	138	300	267	783	540	731	268
	VI	+	+	96	+	+	+	159	336	300	+	+	836	314
R02A	I	+	26	A	71	63	A	A	100	A	A	A	A	A
	II	+	30	A	81	70	72	A	113	A	A	A	A	A
	III	+	34	A	101	79	84	94	139	A	A	271	A	184
	IV	+	43	51	139	97	106	117	183	174	380	338	431	228
	V	9	A	A	A	A	A	A	A	A	A	A	A	A
	VI	10	7	A	A	A	A	A	A	A	A	A	A	A
R03C	I	+	36	A	131	89	91	103	179	169	553	287	382	190
	II	+	43	55	143	97	101	114	193	183	564	320	418	212
	III	+	50	61	163	112	119	133	217	206	598	382	481	250
	IV	+	63	74	+	+	+	171	262	249	660	491	621	314
	V	12	8	A	A	A	A	A	A	A	A	A	A	A
	VI	14	9	A	A	A	A	A	A	A	A	A	A	A
R04C	I	+	29	A	111	73	75	A	148	A	477	A	A	A
	II	+	34	A	121	79	83	95	159	150	487	264	344	A
	III	+	39	50	136	90	97	109	178	168	513	311	393	205
	IV	+	50	60	165	114	125	138	212	202	563	395	502	254
	V	10	A	A	A	A	A	A	A	A	A	A	A	A
	VI	12	7	A	A	A	A	A	A	A	A	A	A	A
R05C	I	+	60	67	+	112	119	126	309	274	753	553	740	244
	II	+	77	85	+	+	138	145	347	308	+	+	+	293
	III	+	+	100	+	+	+	180	+	363	+	+	+	370
	IV	+	+	+	+	+	+	+	+	457	+	+	+	474
	V	+	48	53	165	84	89	94	211	186	532	369	496	A
	VI	+	61	65	+	96	100	106	232	206	593	418	562	204
R06A	I	+	34	A	127	86	86	99	173	164	552	279	377	188
	II	+	40	52	137	93	96	109	185	175	560	310	409	209
	III	+	46	57	155	105	111	126	207	196	590	363	463	245
	IV	+	57	68	+	+	141	157	244	232	649	451	574	304
	V	12	7	A	A	A	A	A	A	A	A	A	A	A
	VI	13	9	A	A	A	A	A	A	A	A	A	A	A
R07A	I	+	+	95	+	+	+	176	+	369	+	+	+	353
	II	+	+	+	+	+	+	205	+	414	+	+	+	425
	III	+	+	+	+	+	+	+	+	+	+	+	+	+
	IV	+	+	+	+	+	+	+	+	+	+	+	+	+
	V	+	74	78	+	+	131	138	300	267	783	540	731	268
	VI	+	+	96	+	+	+	159	336	300	+	+	836	314
R08A	I	18	10	A	A	25	A	A	A	A	A	A	A	A
	II	19	11	A	A	27	A	A	A	A	A	A	A	A
	III	21	12	A	A	29	A	A	60	A	A	A	A	A
	IV	24	15	A	A	35	A	A	69	A	A	A	A	A
	V	6	A	A	A	A	A	A	A	A	A	A	A	A
	VI	6	A	A	A	A	A	A	A	A	A	A	A	A

SEE APPENDIX G FOR RELATED DATA.

SUMMARY OF ALLOWABLE GROSS LOADS IN BRITISH UNITS

FEAT.	PASS INTENSITY LEVEL	PAVEMENT CAPACITY IN KIPS FOR AIRCRAFT GROUP INDEX NUMBERS												
		1	2	3	4	5	6	7	8	9	10	11	12	13
R09C	I	24	13	A	A	34	A	A	72	A	A	A	A	A
	II	+	15	A	A	37	A	A	73	A	A	A	A	A
	III	+	17	A	A	41	A	A	84	A	A	A	A	A
	IV	+	21	A	78	51	A	A	97	A	A	A	A	A
	V	8	A	A	A	A	A	A	A	A	A	A	A	A
	VI	9	A	A	A	A	A	A	A	A	A	A	A	A
R10C	I	18	10	A	A	25	A	A	A	A	A	A	A	A
	II	19	11	A	A	27	A	A	A	A	A	A	A	A
	III	21	12	A	A	29	A	A	60	A	A	A	A	A
	IV	24	15	A	A	35	A	A	69	A	A	A	A	A
	V	6	A	A	A	A	A	A	A	A	A	A	A	A
	VI	6	A	A	A	A	A	A	A	A	A	A	A	A
T01A	I	+	75	60	127	+	117	114	186	174	509	307	408	214
	II	+	+	77	148	+	144	140	212	198	523	380	477	266
	III	+	+	94	+	+	+	186	263	247	581	521	592	363
	IV	+	+	+	+	+	+	+	355	332	694	+	812	+
	V	20	14	A	A	34	A	A	67	A	A	A	A	A
	VI	24	17	A	A	37	A	A	72	A	A	A	A	A
T02A	I	+	56	62	+	103	110	117	301	268	743	546	733	242
	II	+	71	77	+	120	127	136	338	301	+	+	+	290
	III	+	+	90	+	+	+	165	396	352	+	+	+	363
	IV	+	+	112	+	+	+	+	+	431	+	+	+	463
	V	+	44	A	155	77	81	A	202	179	519	361	486	A
	VI	+	55	58	173	88	93	99	225	198	580	405	547	199
T03C	I	+	46	62	173	113	116	134	231	218	726	371	492	246
	II	+	54	71	+	+	129	147	247	234	757	411	535	272
	III	+	61	78	+	+	150	169	276	262	799	484	611	318
	IV	+	77	94	+	+	+	+	330	314	+	+	781	395
	V	14	8	A	A	A	A	A	A	A	A	A	A	A
	VI	16	10	A	A	23	A	A	A	A	A	A	A	A
T04A	I	+	+	+	+	+	+	+	338	315	+	560	701	395
	II	+	+	+	+	+	+	+	382	355	+	+	797	487
	III	+	+	+	+	+	+	+	+	429	+	+	+	+
	IV	+	+	+	+	+	+	+	+	+	+	+	+	+
	V	18	12	A	A	30	A	A	A	A	A	A	A	A
	VI	21	15	A	A	33	A	A	63	A	A	A	A	A
T05C	I	+	52	71	+	+	133	153	264	249	+	424	562	281
	II	+	61	81	+	+	147	168	283	267	+	470	612	311
	III	+	70	89	+	+	+	194	316	299	+	553	698	364
	IV	+	+	107	+	+	+	+	377	358	+	+	+	452
	V	14	8	A	A	A	A	A	A	A	A	A	A	A
	VI	16	10	A	A	23	A	A	A	A	A	A	A	A
T06C	I	+	31	A	124	78	79	93	161	151	507	258	A	A
	II	+	36	49	133	84	87	101	171	161	516	282	360	186
	III	+	40	54	148	95	100	115	189	179	542	327	406	214
	IV	+	50	64	+	118	127	143	223	211	589	406	510	262
	V	12	7	A	A	A	A	A	A	A	A	A	A	A
	VI	13	8	A	A	A	A	A	A	A	A	A	A	A

SEE APPENDIX [illegible] FOR RELATED DATA

SUMMARY OF ALLOWABLE GROSS LOADS IN BRITISH UNITS

FEAT.	PASS INTENSITY LEVEL	PAVEMENT CAPACITY IN KIPS FOR AIRCRAFT GROUP INDEX NUMBERS												
		1	2	3	4	5	6	7	8	9	10	11	12	13
T07A	I	+	+	99	+	+	+	187	297	277	800	491	634	345
	II	+	+	+	+	+	+	+	338	315	821	+	729	428
	III	+	+	+	+	+	+	+	+	386	+	+	+	+
	IV	+	+	+	+	+	+	+	+	+	+	+	+	+
	V	12	7	A	A	A	A	A	A	A	A	A	A	A
	VI	13	9	A	A	A	A	A	A	A	A	A	A	A
T08A	I	+	33	A	110	79	79	A	158	A	434	255	344	A
	II	+	39	A	123	87	88	100	170	162	445	286	376	192
	III	+	44	53	141	99	104	117	192	182	495	340	430	228
	IV	+	56	64	173	+	134	148	229	218	559	430	541	288
	V	16	11	A	A	26	A	A	A	A	A	A	A	A
	VI	18	13	A	A	28	A	A	A	A	A	A	A	A
T09C	I	+	31	A	124	78	79	93	161	151	507	258	A	A
	II	+	36	49	133	84	87	101	171	161	516	282	360	186
	III	+	40	54	148	95	100	115	189	179	542	327	406	214
	IV	+	50	64	+	118	127	143	223	211	589	406	510	262
	V	12	7	A	A	A	A	A	A	A	A	A	A	A
	VI	13	8	A	A	A	A	A	A	A	A	A	A	A
T10A	I	+	+	+	+	+	+	+	338	315	+	560	701	395
	II	+	+	+	+	+	+	+	382	355	+	+	797	487
	III	+	+	+	+	+	+	+	+	429	+	+	+	+
	IV	+	+	+	+	+	+	+	+	+	+	+	+	+
	V	18	12	A	A	30	A	A	A	A	A	A	A	A
	VI	21	15	A	A	33	A	A	63	A	A	A	A	A
T11C	I	+	48	63	175	119	121	138	238	226	737	383	509	253
	II	+	57	73	+	+	135	152	257	243	753	427	557	282
	III	+	66	81	+	+	+	177	289	274	797	509	641	333
	IV	+	+	99	+	+	+	+	349	332	+	+	829	419
	V	16	10	A	A	26	A	A	A	A	A	A	A	A
	VI	19	12	A	A	28	A	A	A	A	A	A	A	A
T12C	I	+	76	82	+	+	143	151	362	322	+	+	+	305
	II	+	+	102	+	+	+	175	+	361	+	+	+	363
	III	+	+	+	+	+	+	+	+	419	+	+	+	451
	IV	+	+	+	+	+	+	+	+	+	+	+	+	+
	V	+	65	69	+	110	116	12[illegible]	273	242	713	487	660	240
	VI	+	+	85	+	+	134	141	304	271	789	553	750	279
A01B	I	+	+	92	+	+	+	162	349	311	+	+	829	299
	II	+	+	+	+	+	+	185	389	346	+	+	829	299
	III	+	+	+	+	+	+	+	+	404	+	+	+	427
	IV	+	+	+	+	+	+	+	+	+	+	+	+	+
	V	+	77	81	+	+	134	139	283	252	719	483	662	249
	VI	+	+	101	+	+	+	158	311	280	797	542	740	286
A02B	I	+	59	64	+	103	108	114	258	228	647	454	610	216
	II	+	74	80	+	118	124	131	285	254	725	521	702	253
	III	+	+	92	+	+	150	157	329	294	832	+	847	306
	IV	+	+	112	+	+	+	199	400	359	+	+	+	375
	V	+	52	55	158	86	90	94	195	174	498	335	455	A
	VI	+	63	67	173	96	101	106	214	191	553	372	510	194

SEE APPENDIX G FOR RELATED DATA.

NOTES

IN REFERENCE TO THE ALLOWABLE GROSS LOAD (AGL) TABLE:

- ***A*** *Denotes lowest possible empty gross weight of any aircraft within the group exceeds the AGL of the pavement. Pavement cannot support aircraft for respective pass intensity level.*

- ***+*** *Denotes no weight restrictions. AGL of the pavement exceeds the greatest possible gross weight of any aircraft in the group.*

The load carrying capacities of the pavements reported herein are based on material properties representative of the in-place conditions at the time this field investigation was conducted.

Pass Intensity Levels V and VI are used for the reduced pavement strengths during the freeze-thaw period.

PAVEMENT CLASSIFICATION NUMBERS BASED ON GROUP 9 AIRCRAFT

FEAT	PCN	FEAT	PCN	FEAT	PCN	FEAT	PCN
R01A	66/R/B/X/T	R02A	7/F/C/X/T	R03C	26/F/C/X/T	R04C	18/F/C/X/T
R05C	45/R/B/X/T	R06A	25/F/C/X/T	R07A	66/R/B/X/T	R08A	0/F/C/X/T
R09C	0/F/C/X/T	R10A	0/F/C/X/T	T01A	27/F/C/X/T	T02A	44/R/B/X/T
T03C	38/F/C/X/T	T04A	63/F/C/X/T	T05C	46/F/C/X/T	T06C	21/F/C/X/T
T07A	53/F/C/X/T	T08A	20/F/C/X/T	T09C	21/F/C/X/T	T10A	63/F/C/X/T
T11C	40/F/C/X/T	T12A	56/R/B/X/T	A01B	61/R/C/X/T	A02B	41/R/C/X/T

RIGID PAVEMENT (ALL SUBGRADES)

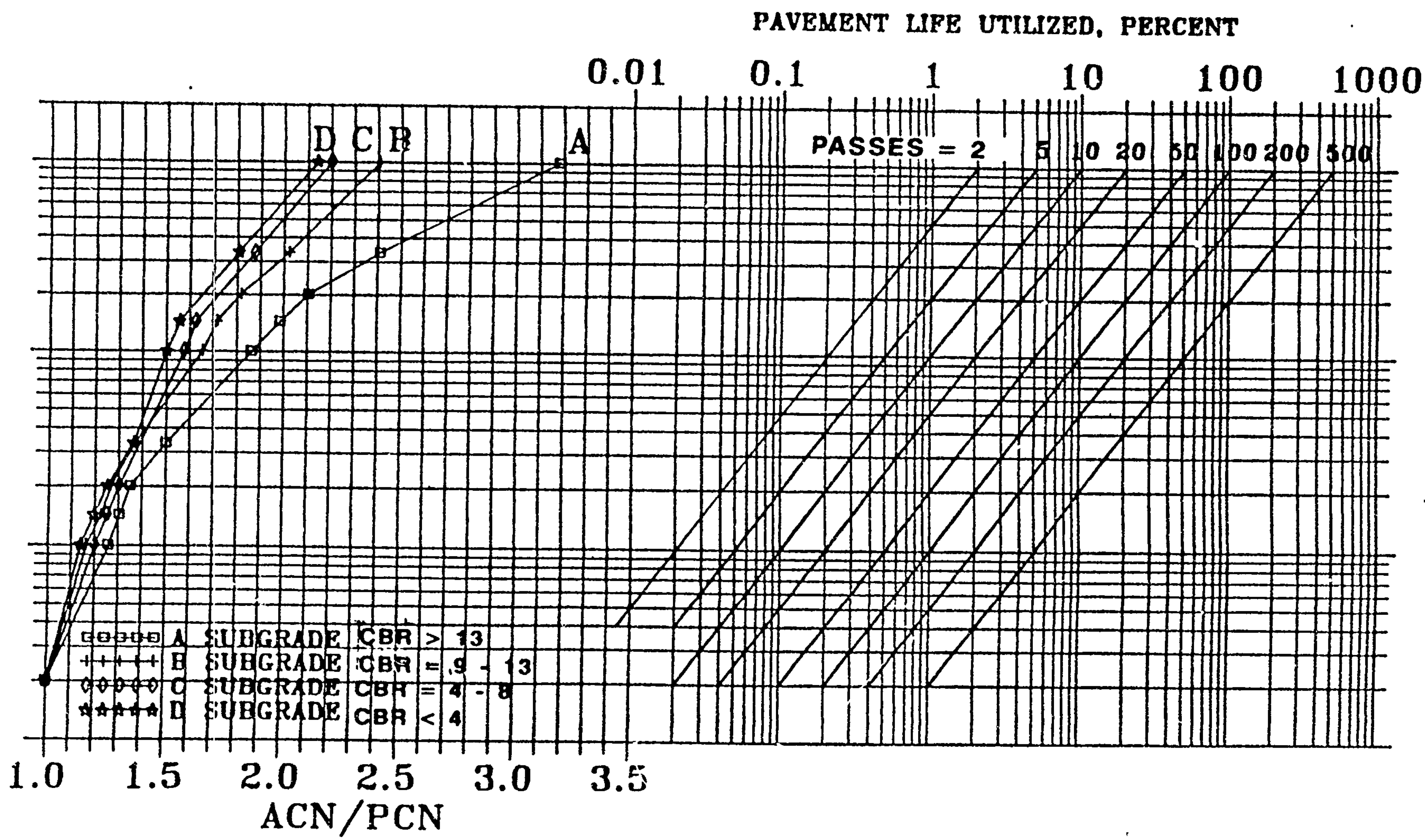


CHART 1

FLEXIBLE PAVEMENT (A,B,C,D SUBGRADES)

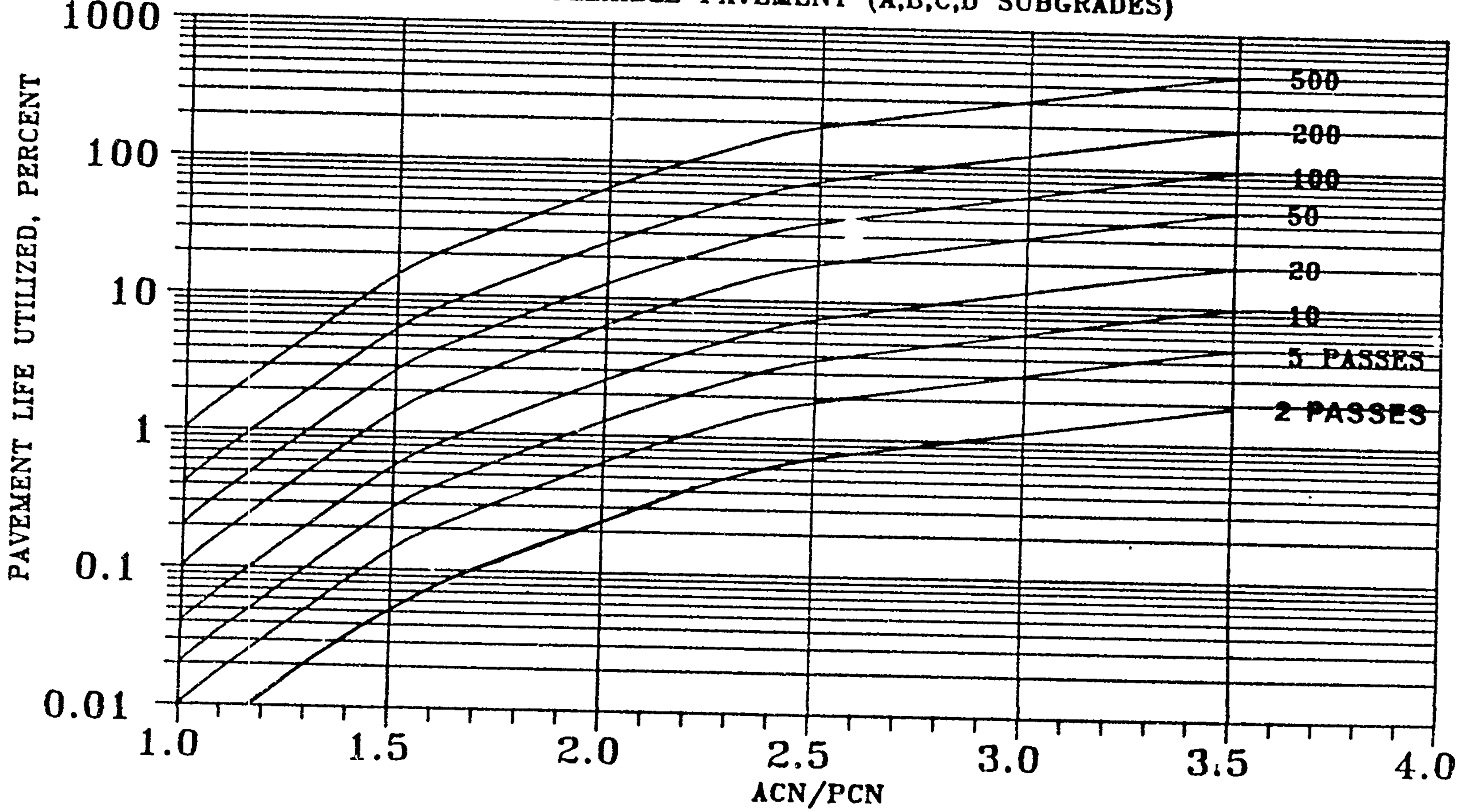
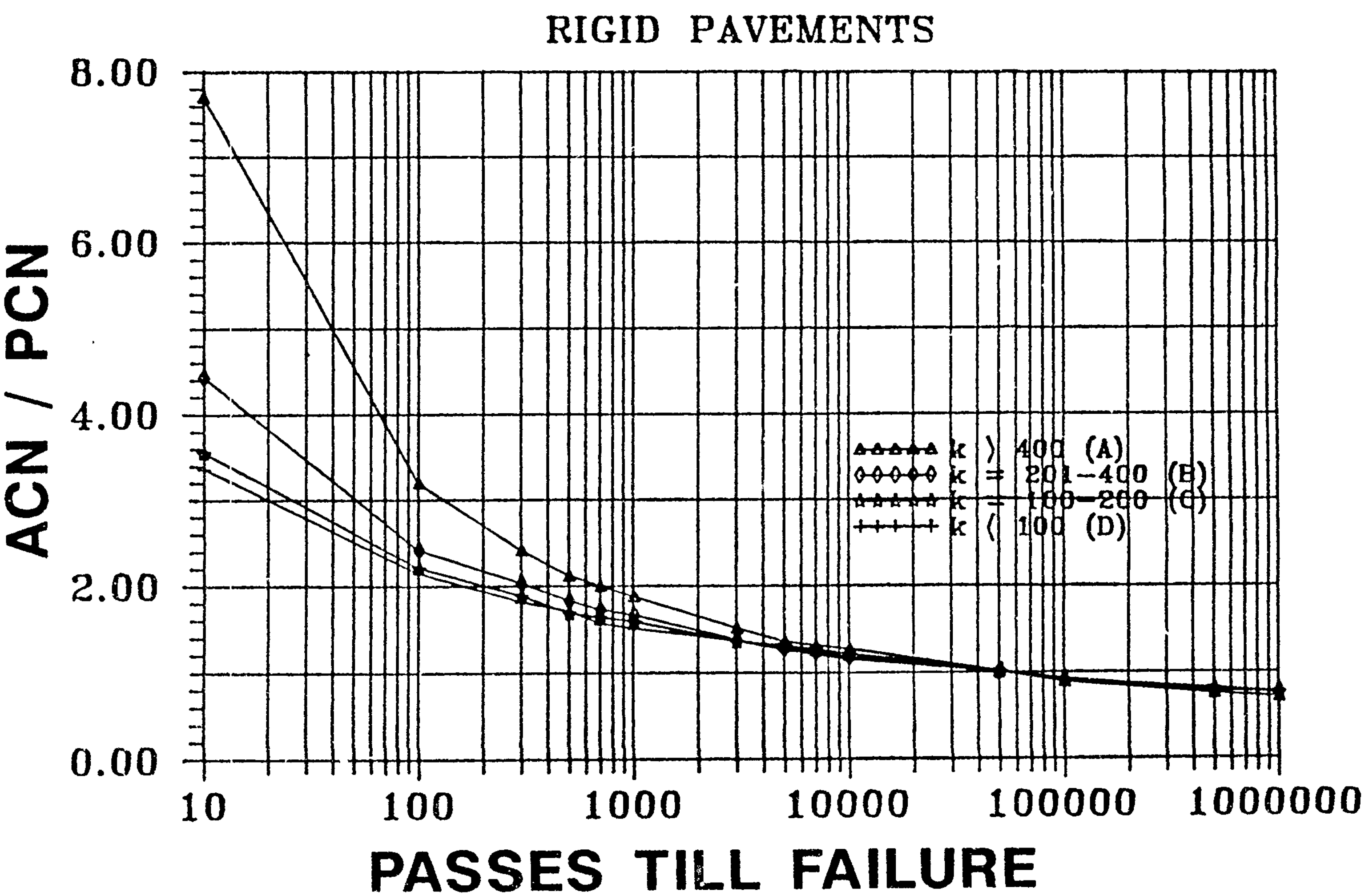


CHART 2



RIGID PAVEMENTS
8.00
6.00
4.00
2.00
0.00
ACN / PCN
k 〉 400 (A)
k = 201–400 (B)
k = 100–200 (C)
k 〈 100 (D)
10
100
1000
10000
100000
1000000
PASSES TILL FAILURE

CHART 3

FLEXIBLE PAVEMENTS

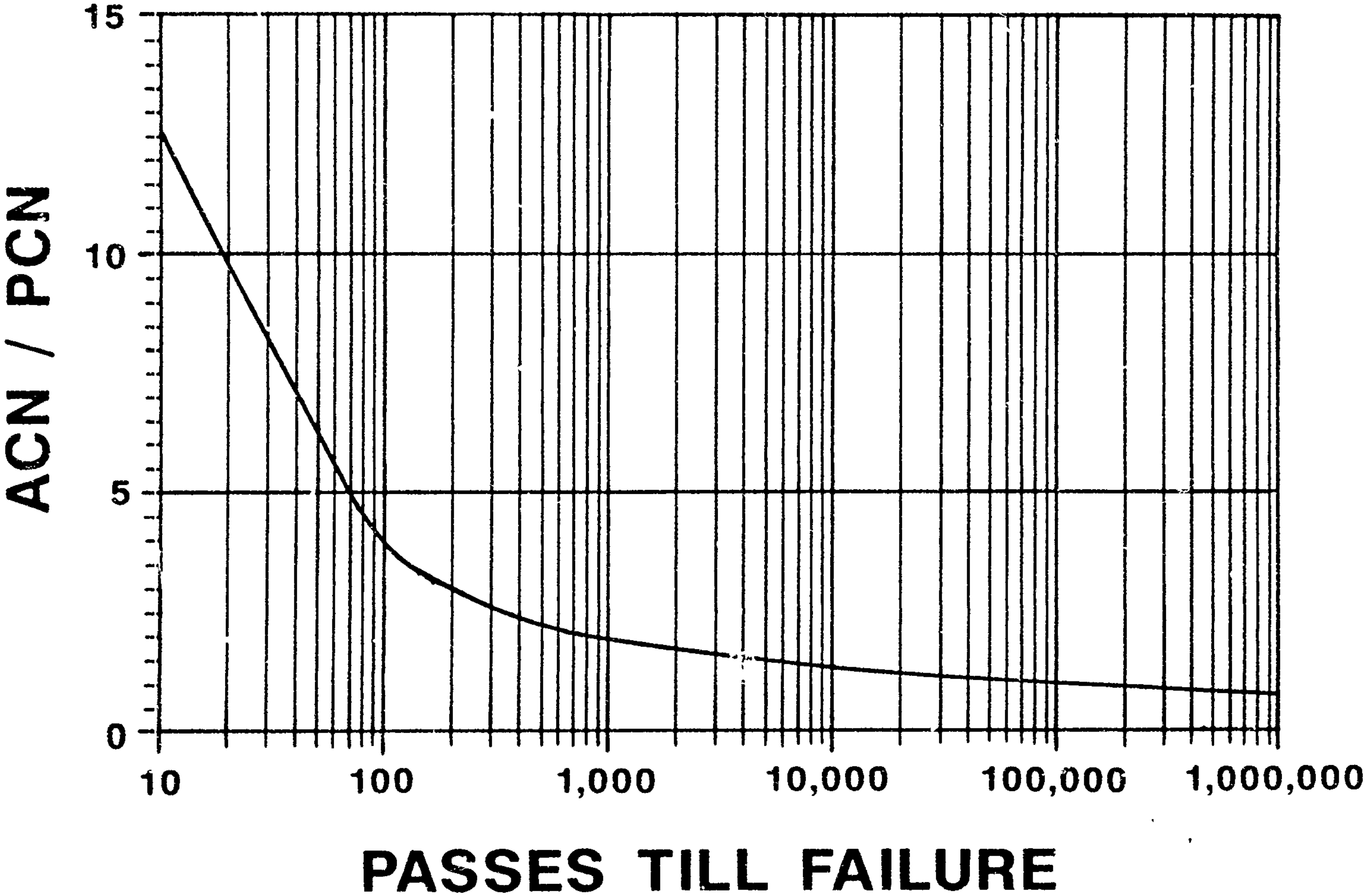


CHART 4

A brief explanation on the PCN code is shown below for PCN = 31/F/A/W/T.

PCN FIVE-PART CODE

PCN /	Pavement Type /	Subgrade Strength /	Allowable Tire Pressure /	Method of PCN Determination
Numeric Value	F - Flexible	A	W	T - Technical Evaluation
		B	X	
31	R - Rigid	C	Y	U - Using Aircraft
		D	Z	

EXPLANATION OF TERMS:

Subgrade Strength Codes

Code	Category	Flexible Pavement CBR, %	Rigid Pavement k, pci
A	High	Over 13	Over 400
B	Medium	9 - 13	201-400
C	Low	4 - 8	100-200
D	Ultralow	< 4	< 100

Tire Pressure Codes

Code	Category	Allowable Tire Pressure, psi
W	High	No Limit
X	Medium	146 - 217
Y	Low	74 - 145
Z	Ultralow	0 - 73

AIRCRAFT GROUP INDEX

LIGHT LOAD			MEDIUM LOAD							HEAVY LOAD		
1	2	3	4	5	6	7	8	9	10	11	12	13
A-37	A-7	*F-111	C-130	C-7	737	*727	707	C-141	C-5	*KC-10	747	B-52
C-12	A-10	FB-111		*C-9	*T-43	C-22	*E-3	*B-1		DC10	*E-4	
C-21	F-4			DC9			C-135	B-757		L1011	VC-25	
*C-23	F-5			C-140			*KC-135			C-17		
T-37	*F-15						VC-137					
	F-16						DC-8					
	F-10X						EC-18					
	T-33						A-300					
	T-38						B-767					
	T-39											
	OV-10											
	C-20											

* CONTROLLING AIRCRAFT

GROSS WEIGHT LIMITS FOR AIRCRAFT GROUPS

	1	2	3	4	5	6	7	8	9	10	11	12	13
	PAVEMENT CAPACITY IN KIPS												
LOWEST POSSIBLE GROSS WEIGHT	5	7	49	69	22	61	92	60	150	325	240	334	180
HIGHEST POSSIBLE GROSS WEIGHT	25	81	114	175	121	125	210	400	477	840	590	850	488
	PAVEMENT CAPACITY IN KILOGRAMS X 1000												
LOWEST POSSIBLE GROSS WEIGHT	2	3	22	31	10	28	42	27	68	147	109	151	82
HIGHEST POSSIBLE GROSS WEIGHT	11	37	52	79	55	57	95	181	216	381	267	385	221

PASS INTENSITY LEVEL

LEVEL	1 – 3	4 – 10	11 – 13
I	300,000 PASSES	50,000 PASSES	15,000 PASSES
II	50,000 PASSES	15,000 PASSES	3,000 PASSES
III	15,000 PASSES	3,000 PASSES	500 PASSES
IV	3,000 PASSES	500 PASSES	100 PASSES
V	300,000 PASSES	50,000 PASSES	15,000 PASSES
VI	50,000 PASSES	15,000 PASSES	3,000 PASSES

NOTES

IN REFERENCE TO THE ALLOWABLE GROSS LOAD (AGL) TABLE :

A Denotes lowest possible empty gross weight of any aircraft within the group exceeds the AGL of the pavement. Pavement cannot support aircraft for respective pass intensity level.

+ Denotes no weight restrictions. AGL of the pavement exceeds the greatest possible gross weight of any aircraft in the group

Pass intensity levels V and VI are used with reduced subgrade strengths to determine the maximum allowable loads during the frost-melt period.

UNITED STATES AIR FORCE
ENGINEERING & SERVICES CENTER
TYNDALL AIR FORCE BASE, FLORIDA

RELATED DATA

ENGINEER	DATE	DRAWING NUMBER
N/A	NOV 89	APPENDIX G
DRAWN: PATRICK	SCALE: N/A	SHEET 1 OF __

CLIMATOLOGICAL DATA

	J	F	M	A	M	J	J	A	S	O	N	D	ANN	YRS REC
TEMPERATURE (°F)														
HIGHEST	72	74	82	90	96	103	106	102	102	90	80	73	106	53
MEAN DAILY MAX	37	39	51	63	73	82	86	84	77	65	52	39	63	53
MEAN DAILY MIN	22	24	33	42	52	62	66	64	57	44	36	26	44	53
LOWEST	-17	-10	-1	18	26	40	46	41	31	20	1	-16	-17	53
MEAN NO OF DAYS														
MAX TEMP ≥ 90 °F	0	0	0	0	1	4	6	4	1	0	0	0	16	53
MIN TEMP ≤ 32 °F	25	22	17	5	*	0	0	0	0	3	12	23	107	53
PRECIPITATION														
MEAN (INCHES)	2.91	2.42	3.40	3.63	3.74	4.50	3.44	3.47	2.60	2.28	3.01	2.75	38.15	45
MEAN NO OF DAYS > 0.5 IN	2	1	2	2	3	3	2	2	2	1	2	2	24	45
SNOWFALL														
MEAN (INCHES)	7.9	5.9	4.3	0.5	T	0	0	0	T	0.1	2.6	5.2	26.5	45
MEAN NO OF DAYS > 6 IN	*	*	*	0	0	0	0	0	0	0	*	*	1	45
RELATIVE HUMIDITY (%)														
MEAN	74	72	68	65	66	66	69	71	71	69	72	75	70	53

MAXIMUM 24 HOUR PRECIPITATION

5.29 INCHES 45 YEARS OF RECORD

MAXIMUM 24 HOUR SNOWFALL

13.9 INCHES 45 YEARS OF RECORD

FLYING WEATHER ANNUAL PERCENTAGES FOR VARIOUS CATEGORIES

A CEILING ≥ 1000 FEET AND VISIBILITY ≥ 3 MILES 89.4 %

B CEILING 500 900 FEET AND VISIBILITY ≥ 1 MILE, OR VISIBILITY ≥ 1 MILE BUT < 3 MILES AND CEILING ≥ 1000' 8.3 %

C CEILING < 500 FEET AND OR VISIBILITY < 1 MILE 2.3 %

D INSTRUMENT. CEILING ≥ 200 FEET AND VISIBILITY ≥ 1/2 MILE AND EITHER CEILING < 1500 FEET OR VISIBILITY < 3 MILES 13.4 %

SOURCE OF DATA DATSAV RUSSWO (WRIGHT-PATTERSON AFB) *= LESS THAN 0.5 DAY T= LESS THAN 0.05 INCH

ANNUAL WIND COVERAGE TABULATION

RUNWAYS OR COMBINATIONS FOR CROSSWIND COMPONENT 10 KNOTS OR LESS

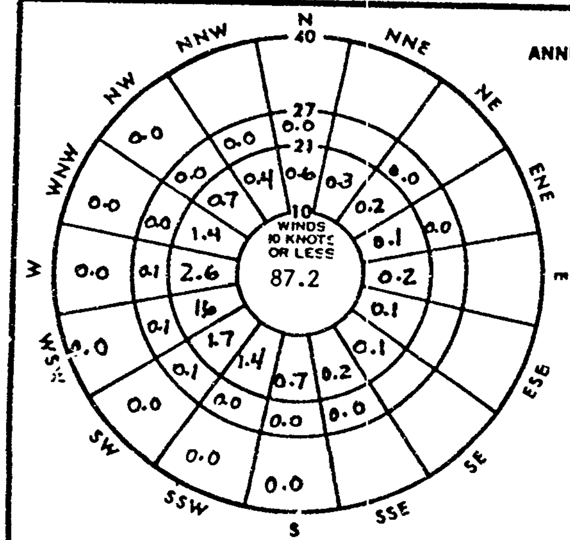
RUNWAY DIAGRAM	MAGNETIC MARK	TRUE BEARING	LENGTH IN FEET	(1)	(2)
	06-24		8999'	95.0	93.8
	15-33		5499'	91.8	92.0

INSTRUMENT RUNWAY
(1) WIND COVERAGE (%) - ALL WEATHER
(2) WIND COVERAGE (%) - INSTRUMENT

ADDITIONAL DATA

FIELD ELEVATION 1052 FEET MSL
MAGNETIC VARIATION 3°00W
SOURCE FLIP
YEAR 1990

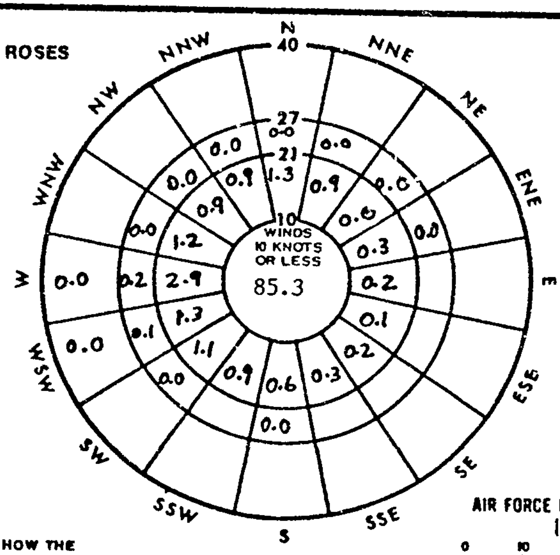
ANNUAL WIND ROSES



ALL WEATHER

NOTE

THESE WIND ROSES SHOW THE TOTAL % OF WINDS BY SPEED GROUP AND DIRECTION BASED ON TRUE BEARING.



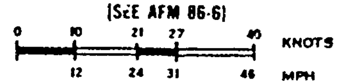
INSTRUMENT

ENGINEERING WEATHER DATA

AIR CONDITIONING DESIGN AND CRITERIA DATA (SEE AFM 88 8, CHAP 6)
WINTER HEATING DESIGN TEMPERATURE (SEE AFM 88 8, CHAP 6)
MEAN WINTER WIND SPEED 7 KNOTS
MEAN ANNUAL NUMBER OF HEATING DEGREE DAYS 5495 (SEE AFR 91-7)
PRESSURE ALTITUDE AND TEMPERATURE DATA FOR DETERMINING REQUIRED RUNWAY LENGTHS (SEE AFM 86-2)
EXTREME WIND DATA FOR CONSTRUCTION DESIGN (SEE AFM 88-3, CHAP 1)
SNOW LOAD DATA FOR ROOF CONSTRUCTION (SEE AFM 88-3, CHAP 1)
MAXIMUM FROST PENETRATION (SEE AFM 88-3, CHAP 1)
MEAN ANNUAL NUMBER OF COOLING DEGREE DAYS 1025

NOTICE WHEN NECESSARY, INTERPRETATIONS OF THESE DATA SHOULD BE SECURED THROUGH THE LOCAL STAFF WEATHER OFFICER

AIR FORCE RUNWAY WIND COMPUTER (SEE AFM 86-6)



SPRINGFIELD ANGB, TN
39° 50N 83° 50W
1052'
PREPARED BY USAFETAC
JAN 91

TAB D

FORM REVISED 1 DEC 77

SPRINGFIELD ANGB, OHIO

TOPOGRAPHY

Springfield ANGB is located in west central Ohio at an elevation of 321 feet. The Airfield is located four miles south of the city of Springfield and ten miles northeast of Dayton. The base is located in the wide and generally flat Miami River Valley between the Little Miami River (three miles south) and the Mad River (four miles north). The area surrounding the base consists of flat to slightly rolling hills, with a light industrial base and some light farming. Thirty miles to the southeast, at the closest edge of the river valley, higher, wooded lands begin. In addition to the rivers there are many small creeks and ponds in the area, the largest of these is the Clarence Brown Lake, six miles to the northeast. Another major moisture source is the Great Lakes, 140 miles to the north.

VISIBILITY

Low visibilities and restrictions to vision constitute a problem at Springfield. This is due to the large industrial base in the area (especially in Dayton) and the many moisture sources. There will be 251 days per year with obstructions to vision reported, with smoke or haze on 207 days and fog on 181 days. Both fog and smoke reach a peak in August with 20 days of fog and 23 days with smoke. Visibilities will be below ten miles on 161 days per year and below five miles on 61 days per year. Visibilities will be below three miles on 27 days spread evenly throughout the year and they will be below one mile on five days during the year (normally during the winter months). Visibilities will drop below one half mile on two days per year. Blowing snow also contributes six days of obstruction peaking in January with two days. Blowing dust is not significant with less than one day of occurrence per year.

SEVERE WEATHER

There will be 44 days per year with thunderstorms in the Springfield area. These storms will reach a peak during July with eight days. These storms can be severe with strong winds and hail. Hail will occur on two days per year with the best chance in May. Tornadoes can and have occurred in the local area, several have come within 15 miles. The most severe outbreak of tornadoes was on Palm Sunday in 1974. There will be precipitation of some type reported on 191 days each year, peaking during January with 21 days. Snow will occur on 58 days during the winter with January having 15 days. Freezing precipitation can also be a proble with six days per year with January again being the worst with two days. The peak wind in the area is a gust of 85 knots at Wright-Patterson AFB, seven miles to the east-southeast. The mean wind chill for January, the coldest month is 12 degrees Farenheit, however the mean chill temperature is below 20 degrees from December through Febuary.